ASM REVIEW OF METAL LITERATURE 1945

A. C. Forsyth.

REVIEW OF METAL LITERATURE

An Annotated Survey of Articles and Technical Papers Appearing in the Engineering, Scientific and Industrial Journals and Books Here and Abroad.

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PREFACE

The A.S.M. Review of Current Metal Literature is a monthly feature of the *The Metals Review,* published by the American Society for Metals and distributed to its members. The present volume is a collection of the installments published in *The Metals Review* from February 1945 through January 1946, and represents a complete survey of all of the metallurgical literature published during the period January through December 1945. It is a sequel to the first volume which covered the year 1944.

The annotations are not intended to serve as a substitute for a reading of the articles listed. They are brief abstracts designed to indicate the scope and content of the article so that you may determine whether it is something you want to read in its entirety.

Attention is called to the table of contents immediately following and to the subject index starting on page 755. The table of contents lists the various subdivisions and classifications with explanatory notes on each; this classification is arranged primarily by processes. The subject index supplants and greatly amplifies the "Materials Index" published in the monthly issues of *The Metals Review.* While the emphasis here is placed on materials, processes are likewise indexed in detail in this section of the book. Subheads and cross-references are included in sufficient detail to permit the location of articles on any specific subject related to the metal industry. Indexing is based on the content of the article and not merely on the title.

In using the book, if the primary interest is in the broad field of corrosion, or foundry practice, or welding,

turn immediately to the respective section as given in the table of contents. If the main interest is in aluminum alloys, or copper, or cast iron, turn to the corresponding heading in the subject index. If interest lies in specific aspects of corrosion, or a particular type of welding, these broad processes will be found broken down and subdivided in the subject index. An author index is also provided and a list of addresses of the publications annotated.

The present 1945 edition contains some changes in the system of classification as shown in the table of contents. The changes are minor and affect the general classification system adopted in the 1944 edition only slightly. The major revisions occur in Section 1, 2, 3, 7, 9, 12 and 21.

Every effort has been made to render the Metal Literature Review complete, so that in consulting it the reader can be assured that he is being referred to *all* of the material published during the prescribed period on the specific subject he is studying. The cooperation of Battelle Memorial Institute with the editors of *The Metals Review* in attempting to make the annotations accurate, complete, and useful is gratefully acknowledged.

AMERICAN SOCIETY FOR METALS

June 1, 1946

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SECTION I

ORES & RAW MATERIALS

Production; Mining; Beneficiation

1-1. **Thermal Methods for Hydrogen Production.** D. D. Howat. *Chemical Age,* v. 51, Dec. 9, '44, pp. 539-543.
Steam-iron process.

1-2. **Iron Ore Beneficiation Assumes a Major Role in the Manufacture of Pig Iron.** Wm. A. Haven. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 81-83, 89.
Developments in the beneficiation of blast furnace raw materials, which offer opportunities for increasing production and for reducing costs in the manufacture of pig iron.

1-3. **Recent Developments in Iron Ore Beneficiation in the United States.** T. B. Counselman. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 90-95, 156, 160-161.
Mesabi ores; use of turbos; the Dorrco Sizer; flotation; treatment of magnetic taconites; concentration of brown ores; concentration of red ore; treatment of ores in eastern magnetite area; East Texas iron ores.

1-4. **Large Scale Working of Adirondack Magnetites.** Frank J. Oliver. *Iron Age,* v. 155, Jan. 25, '45, pp. 50-55.
Mines abandoned years ago reopened, active mines greatly expanded in activity and $40,000,000 worth of modern mining and concentrating equipment has been installed to produce a high grade magnetite sinter from ores ranging from lean to rich. Depletion of high grade Lake Superior ores lends them a new importance. Economic factors compared in order to evaluate the permanence of this activity and its influence on blast furnace practice.

1-5. **Large Scale Working of Adirondack Magnetites.** Frank J. Oliver. *Iron Age,* v. 155, Feb. 1, '45, pp. 52-56.
Methods of beneficiating; crushing and fine grinding enables a concentrate containing up to 70% iron to be obtained by magnetic separation. The product is then sintered.

1-6. **Ore Concentration and Milling.** F. M. Jardine. *Mining and Metallurgy,* v. 26, Feb. '45, pp. 63-65.
New types of equipment noted, and sink-float continues to gain.

1-7. **Non-Metallic Minerals.** Oliver Bowles. *Mining and Metallurgy,* v. 26, Feb. '45, pp. 75-80.

New deposits, new methods, and new uses for a variety of industrial minerals.

1-8. **Metallurgy of Ferro-Alloy Ores.** Jerome Strauss. *Mining & Metallurgy,* v. 26, Feb. '45, pp. 97-98.

Many processes still war secrets; new manganese and nickel plants closed down.

1-9. **Selenium Recovery.** A. G. Arend. *Chemical Age,* v. 52, Jan. 6, '45, pp. 11-14.

Development in metallurgical processes.

1-10. **Alcoa's New Alumina Development Laboratory.** *Chemical Industries,* v. 56, Jan. '45, pp. 54-58.

Costing $750,000, this flexible experimental plant can reproduce with variations the new Alcoa "combination" process for alumina from low-grade bauxites.

1-11. **Mineralogy of the Manganese Oxides.** Michael Fleischer. Electrochemical Society Preprint no. 86-23, Oct. '44, 1 p.

Mineralogical characteristics of manganese ores are probably of major importance in determining their behavior in dry batteries. Available data on crystal structure, X-ray diffraction patterns, physical properties, and chemical composition of 12 minerals are summarized, with pertinent discussion. Identifications based on physical properties are highly uncertain, owing to the variability and overlapping of these properties. Hardness is a particularly poor criterion. Optical study by reflected light makes identification of well-crystallized material possible but identification of fine-grained material in this way is as yet uncertain. X-ray powder photographs are the best means.

1-12. **Flotation and Heavy-Media in Ore-Dressing Spotlight.** S. J. Swainson. *Engineering & Mining Journal,* v. 146, Feb. '45, pp. 116-118.

With new plants being built and older ones expanded, development of new mineral-dressing equipment became noticeable once more. Flotation-machine and fine-grinding theories received increased attention.

1-13. **Minerals Used at Fontana Steel Plant.** F. Conrad. *Mining Journal,* v. 28, Feb. 28, '45, pp. 6-7.

Minerals required to produce the 1,000 tons of molten iron poured each day by the blast furnace at the Kaiser Company's Fontana steel plant. In addition, other materials are required for the open-hearth and the foundry. Major sources of supply are located in four western states and in Mexico. Shipments by rail are unloaded by a rotary car dumper capable of handling 384 cars a day.

1-14. **Principles of the Pedersen Alumina Process.** H. Pedersen, H. Ginsberg and F. W. Wrigge. *Metall und Erz.,* v. 41, Feb. '44, pp. 32-35; April '44, p. 86. British Non-Ferrous Metals Research Association *Bulletin,* v. 25, Jan. '45, p. 6.

Recent development of the process, in which bauxite (including high silica material) is processed in the electric furnace with lime, the product being treated with sodium carbonate solution. Paper gives flow-

sheet of the process and the relevant part of Rankin's silica-alumina-lime diagram. Reference to plants in Southern France, Norway, Russia and Sweden. For an English account of the Pedersen process based on this German paper, see *Industrial Chemist,* v. 20, no. 236, Sept. '44, pp. 498-500.

1-15. **Flotation of Ores an Individual Problem.** R. A. Pallanch. *Mining & Metallurgy,* v. 26, March '45, pp. 167-169.

Individual ingenuity is the prime requisite of a good operator. Ideas can be gained from another operator but often they do not work at home.

1-16. **The Coinage Metals in Antiquity, III.** Douglas Rennie Hudson. *Metallurgia,* v. 31, March '45, pp. 249-252.

Critical review of metal extraction and craftsmanship, since the third millennium B.C., of Phoenicia and deals with metalliferous mining in Spain, silver and other metals; scripts; Phoenician metallurgy, bronze, ras shamra, byblos and includes a consideration of the vigorous metal culture of South Russia.

1-17. **The Combination Process for Alumina.** Junius D. Edwards. *Metals Technology,* v. 12, April '45, T.P. 1833, 5 pp.

Bayer process, lime-soda process, and Alcoa combination process utilizing high silica bauxites and employing a sintering operation as a cyclic step in the Bayer process.

1-18. **Alumina-From-Clay Plant at Salem, Oregon.** C. K. White. *Mining Congress Journal,* v. 31, April '45, pp. 32-34.

Demonstration plant now under construction will employ the ammonium bisulphate process for the first time on a commercial scale. This is one of the important steps being taken in the development of the aluminum industry in the northwest.

1-19. **Design and Operation of Modern Sintering Plants.** C. J. Duby. *Iron & Steel Engineer,* v. 22, May '45, pp. 39-44, 61.

Sintering is not an innovation; the process received great impetus in recent years as a means of increasing blast furnace production. The design of the new plants shows many improvements, particularly in the material handling facilities.

1-20. **New Use Patterns Required for Survival of Wartime Metallurgical Innovations.** R. S. Dean. *Mining & Metallurgy,* v. 26, June '45, pp. 289-291.

Trend to exhaustion of our high grade ores may not necessarily require dependence upon imports from other countries to meet our deficiencies. Present technology and use-patterns have been developed for treatment of high grade ores. We should try to devise, far in advance of urgent needs, other technologies and use-patterns that utilize such ores as we actually have.

1-21. **Postwar Prospects for Fluorspar Are Bright.** William H. Waggaman and Oliver C. Ralston. *Mining & Metallurgy,* v. 26, June '45, pp. 295-299.

New uses for fluorspar derivatives have been developed, including use of hydrofluoric acid in the manufacture of high-octane gasoline, and of freon as a refrigerant and component of insecticides. To meet expanded requirements, ore reserves are none too large.

1-22. **Principles of Comminution—Size and Surface Distribution.** A. M. Gaudin and S. Suphi Yavasca. *Mining Technology,* v. 9, May '45, T.P. 1819.

Summarized comparison of experimental values for surface factors for various mineral substances at various sizes. Results described show that in the fine sizes the new surface per grade is independent of size whether the solid be crystalline or glassy, cleavable or not, soft or hard. 4 ref.

1-23. **Short-Rod Grinding in Ball Mills.** H. R. Stahl. *Mining Technology,* v. 9, May '45, T.P. 1821.

Concentration practice has attempted to carry size reduction to a point where economic unlocking of the galena is obtained, without causing undue sliming of the very friable galena.

1-24. **Determination of Ball-Mill Size from Grindability Data.** Stanley D. Michaelson. *Mining Technology,* v. 9, May '45, T.P. 1844.

Method to determine mill size with a reasonable degree of accuracy. Selection of the proper size and type of mill made on an empirical basis. 4 ref.

1-25. **Development in Bismuth Recovery.** A. G. Arend. *Industrial Chemist,* v. 21, Apr. '45, pp. 199-202.

By-product sources; scrap brasses; concentration and refining; elimination of lead; electrolytic refining; make-up.

1-26. **The Treatment of Gold Ores.** F. B. Michell. *Mine & Quarry Engineering,* v. 10, May '45, pp. 107-115.

Introduction, general principles, grinding gold ores, plate amalgamation, amalgamation of concentrates, application and practice of flotation, cyanidation and precipitation, treatment of simple or free-milling ores, placers, and simple sulphide ores.

1-27. **How Basic Magnesium Improved Its Pelletizing.** Fred D. Gibson. *Engineering and Mining Journal,* v. 146, June '45, pp. 84-86.

Basic Magnesium, Inc., began life as a high-cost producer, but by the time the accumulated stockpile of magnesium had forced the government to close the plant in December, 1944, operating costs had been brought down to a competitive level. Among the most effective cost-cutting improvements were the changes made in preparation and handling of raw material.

1-28. **Raw Material in Post-War Planning.** W. G. Mochrie. *Foundry Trade Journal,* v. 76, May 24, '45, pp. 73-74.

Melting virgin metals; scrap metal; utilization of ingots; influence of current practice on future supply; light alloys.

1-29. **The Treatment of Gold Ores.** F. B. Michell. *Mine & Quarry Engineering,* v. 10, June '45, pp. 139-144.

Introduction, general principles, grinding gold ores, plate amalgamation, amalgamation of concentrates, application and practice of flotation, cyanidation and precipitation, treatment of simple or free-milling ores, placers, and simple sulphide ores. 20 ref.

1-30. **Metallurgical Tests of Sheep Tanks Ore.** Edwin Walter Mills. *Mining Journal,* v. 29, July 15, '45, pp. 5-6.

Possibility of low-cost production of manganese and manganese products from the Sheep Tanks mine is indicated by recent metallurgical tests which show that the manganese content of the ore can be recovered as a commercial byproduct when the ore is leached by either the dithionate process or the sulphur dioxide process.

1-31. **Modern Treatment of Manganese.** A. G. Arend. *Chemical Age,* v. 52, June 2, '45, pp. 485-487.

Wet extraction and deposition.

1-32. **Design and Operation of Modern Sintering Plants.** *Industrial Heating,* v. 12, July '45, pp. 1157-1158.

Design and operation of plants and type of sintering machine.

1-33. **The Production of Magnesium—Part I.** *Industrial Chemist,* v. 21, July '45, pp. 351-358.

Survey of the process developed by Magnesium Elektron Limited. Thermal balance of components; "classical" process; chlorinator reactions; electrolysis; subsequent developments; pellet form mix; elimination of peat.

1-34. **The Alumina Problem in Peace and War.** Francis C. Frary. *Chemical & Engineering News,* v. 23, Aug. 10, '45, pp. 1324-1327.

To produce 1 lb. of aluminum it is necessary first to produce two of alumina. Increases in aluminum capacity brought on by war bring up questions of raw materials and processes. Bayer process; use of other raw materials; other processes; alunite; aluminum for aircraft. 9 ref.

1-35. **The Melting Point of Manganese and Iron Ores.** John J. Howard. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 971-972.

Behavior of the various ores in the furnace. The ideal condition for chemical reaction is the gaseous phase, because the reagents are miscible in all proportions and molecular contact is possible to the greatest extent.

1-36. **Modern Electro-Treatment Processes for the Extraction of Minerals.** A. G. Robiette. *Metal Treatment,* v. 12, summer '45, pp. 116-127.

Survey of those electro-thermal processes for the extraction of minerals which might profitably be developed in this country. The prospect of such development is considered in relation to the scheme for the production of large quantities of cheap hydro-electric power in the

Highlands. Importance of electro-thermal processes from national point of view; electro-thermal processes; electrodes; furnaces; calcium carbide; ferro-alloys; ferrochrome; magnesium; abrasives and refractories; graphite and carbon products; phosphorus.

1-37. **A Rapid Method of Ore Testing: The "S.K." Porosity Test.** Iron and Steel Institute, Advance Copy, July '45, 10 pp.

Apparatus described for the rapid determination of the porosity of ores by what is known as the "S.K." (South Kensington) test. Principle of the test is to fill the voids in turn with mercury, air, and water; for porous materials the voids are greatest for air, less for water, and least for mercury. The differences between the values are a measure of the porosity relative to the fluids employed. Several specimens of ore and sinter were examined. Ores are more porous than sinters, while the voids of mixtures are additive. It is shown how the measurements can be applied to forecast the behavior of materials in the blast furnace (deoxidation and carbon deposition).

1-38. **Future Copper Production From Low-Grade Ores.** Harmon E. Keyes. *Mining Journal,* v. 29, Sept. 15, '45, pp. 5-7, 41.

To avert a future copper shortage exploitation of marginal and refractory copper ores will be necessary. It is believed that this may be achieved, at least in part, by leaching of marginal grade ore in dumps or stopes, and treating milling grade "mixed" ore by the leach-precipitation-flotation process. For this process the production of a cheaper leaching solvent, namely, ferric sulphate and sulphuric acid, is a prime requisite. 43 ref.

1-39. **Sinters and Sintering—Part I.** H. L. Saunders and H. J. Tress. Iron and Steel Institute, Advance Copy, Aug. '45, 13 pp.

Sinter in the blast furnace burden is beneficial in spite of its lower reducibility as compared with ore. Differences in the behavior of ore and sinter towards furnace gas are considered. Some of the changes occurring during the various stages of sintering are outlined, with special reference to the effect of temperature on porosity and strength. In usual commercial practice the bonding temperature is far too high, with the result that unnecessary slagging and loss of porosity result. Need for closer control is stressed, and various suggestions for modifications to existing plant are made.

1-40. **Sinter Plants.** C. J. Duby. *Iron and Steel,* v. 18, Aug. '45, pp. 379-382.

Design and operation. (American Iron and Steel Engineers.)

1-41. **Alumina From Low-Grade Bauxite.** Robert F. Gould. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Sept. '45, pp. 786-802.

Red mud slurry is ground with limestone and soda ash and kilned at high temperature; the sinter is leached with water, and the filtrate is passed into the process liquors of the Bayer process where alumina and soda ash are

recovered. Various economic factors and future possibilities of the process are considered.

1-42. **The Technical Basis of Atomic Explosives.** *Electronics,* v. 18, Oct. '45, pp. 109-113.
Production and use of the two principal atomic explosives, uranium-235 and the new element plutonium.

1-43. **Uranium and Its Isotopes.** *Metal Industry,* v. 67, Sept. 28, '45, p. 201.
General principles of the atomic bomb — separation methods.

1-44. **Vanadium—A Metal Named for a Goddess.** C. H. Vivian. *Compressed Air Magazine,* v. 50, Oct. '45, pp. 260-264.
History of vanadium.

1-45. **Magnetic Separation.** R. H. Stearns. *Steel,* v. 117, Oct. 22, '45, pp. 120, 122.
Method of segregating materials finding many new uses in industry. Magnetic separation considered necessary under four classifications: Purification, protection, recovery and segregation.

1-46. **Open-Hearth Charge Ores.** Clyde Denlinger. American Iron and Steel Institute Yearbook, Advance Copy, 1945, 9 pp. Also *Blast Furnace & Steel Plant,* v. 33, Oct. '45, pp. 1258-1261, 1277.
Wartime need for using more pig iron in making open-hearth steel to offset the reduced supply of scrap imposed new problems of raw materials selection. Selection of iron ores to counteract the additional amount of carbon present in pig iron has presented problems as to grade of the ore, analysis, and preliminary treatment. Steelmakers adept in varying procedures to utilize available raw materials.

1-47. **Agglomeration of Fine Taconite Concentrates.** M. F. Morgan. *Steel,* v. 117, Oct. 1, '45, pp. 132, 135-136, 138, 166, 168, 170.
History of Davis agglomerating process, nodulizing, briquetting and sintering of iron-bearing materials and the merits of each method are presented. Industry is confronted with problems after taconites are successfully concentrated. Estimated costs of taconite sinters are compared.

1-48. **Microchemical Analysis of Sphalerite From Kristineberg, Sweden.** Anna-Greta Hybbinette. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 654-661.
Because the presence of iron as marmatite in sphalerite may cause serious loss of zinc, knowledge of the amount of iron remaining after flotation is important. Difficulty in collecting samples of pure sphalerite made desirable application of micromethods to the analysis of six samples of sphalerite from the Kristineberg mine in Sweden, varying in color from pale yellow to brown; the procedure used is presented here in detail. The iron content was found to vary from 1 to 8.5%, corresponding to a variation of 65 to 58% in zinc content. The normal composition of

sphalerite from the Kristineberg mine is approximately 64% zinc, 2.5% iron, 0.2% cadmium, and 33% sulphur. 28 ref.

1-49. **Fluorescent Bead Test for Uranium in Minerals: A Critical Study.** M. Allen Northup. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 664-670.

Fluorescent sodium fluoride bead test will detect 0.05 microgram of uranium in a single grain of sample. It is specific except for columbium, which gives a fainter fluorescence. Excess cerium or rare earths interfere. Both troubles are overcome in minerals containing over 1% of uranium by adjusting the ratio of sample to sodium fluoride. An ether extraction method for separating uranium from columbium, cerium, and the rare earths permits detection of 0.0001% of uranium in 0.5 gram of columbite or non-uraniferous cerium minerals. Excess silicon dioxide, titanium dioxide, etc., may suppress fluorescence, but can be removed by extra heating. About 1 mole of uranium in 2000 of sodium fluoride forms a fluorescent complex when fused. At low flame temperatures any excess remains undissolved. At higher temperatures excess is converted to sodium uranite. 11 ref.

1-50. **The Treatment of Complex Gold Ores.** F. B. Mitchell. *Mine & Quarry Engineering,* v. 10, Oct. '45, pp. 245-251.

Sulpho-tellurides ores; base-metal ores containing gold; lead-gold ores; zinc-gold ores. 23 ref.

1-51. **A Note on Uranium.** *Mine & Quarry Engineering,* v. 10, Oct. '45, p. 244.

Occurrence; Great Bear Lake region.

1-52. **Nickel From Cuba.** Maurice F. Dufour and Robert C. Hills. *Chemical Industries,* v. 57, Oct. '45, pp. 621-627.

Nicaro produces nickel oxide by leaching with ammonia. In three years the process was developed from a pilot plant processing one ton of ore per day to a commercial installation capable of handling 3600 tons of ore per day.

1-53. **Sinters and Sintering.** H. L. Saunders and H. J. Tress. *Blast Furnace & Steel Plant,* v. 33, Nov. '45, pp. 1385-1390.

General survey of the physical and chemical changes involved, together with a more detailed study of special aspects of the process.

1-54. **Geological Description of the Mesabi Range Taconites.** Stephen Royce. *Skillings Mining Review,* v. 34, Nov. 17, '45, pp. 1-2, 4, 13.

Succession of formation; detail description of the taconites.

1-55. **Principles of Iron Ore Beneficiation. Part I.** Charles E. Agnew. *Steel,* v. 117, Nov. 26, '45, pp. 124, 126, 144, 146, 148, 150, 152, 154, 156, 158.

Describes various processes of beneficiation including sintering, nodulizing, briquetting and pelletizing and presents characteristics of the respective products. Work accomplished by blast furnace shaft in preparing raw materials for smelting in bosh and hearth explained in detail.

1-56. Principles of Iron Ore Beneficiation. Part II. Charles E. Agnew. Steel, v. 117, Dec. 3, '45, pp. 134, 170, 172, 174, 176, 179, 180, 182, 184, 186.

Work accomplished by shaft operation summarized. Hearth and bosh reactions indicate constant change in chemical compositions of material on its way through these zones. Preparation capacity of many stacks burdened on soft ores not equal to smelting capacity of bosh and hearth.

1-57. The Cerro de Pasco Enterprise. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 507-508.

A general review.

1-58. Mining Methods at the Cerro de Pasco Properties. V. L. McCutchan. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 520-533.

Cerro de Pasco; Morococha; Casapalca; San Cristobal; Yauricocha; Goyllarisquisga; ventilation; explosives; haulage and hoisting; mining equipment; timber.

1-59. Ore Concentration. T. R. Wright. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 534-539.

Cerro de Pasco Copper Corp. milling practice. Four plants use selective flotation on complex ores.

1-60. Further Notes on Milling Practice and Flowsheet Details. D. S. Sanders. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 540-544.

Discussion of practice at four mills of the Cerro de Pasco Copper Corp.

1-61. Principles of Iron Ore Beneficiation and Their Effects on Blast Furnace Operation. Part III. Charles E. Agnew. *Steel,* v. 117, Dec. 10, '45, pp. 122-124, 126, 144.

Interesting thermal influences of slag compositions on stack operation disclosed by calculations of blast furnace slags from burdens of equal weight. Slight change in slag constituent ratio markedly affects silicate compositions.

1-62. Sinters and Sintering. H. L. Saunders and H. J. Tress. *Metal Treatment,* v. 12, Autumn '45, pp. 201-210.

Differences in behavior of ore and sinter towards furnace gas. Changes occurring during various stages of sintering outlined with special reference to the effect of temperature on porosity and strength. From a study of laboratory sinters, it is shown that in usual commercial practice the bonding temperature is too high, resulting in unnecessary slagging and loss of porosity.

1-63. Principles of Iron Ore Beneficiation. Part IV. Charles E. Agnew. *Steel,* v 117, Dec. 17, '45, pp. 125, 128, 164, 166, 168.

Discusses influence of silicate composition of slags on the thermal conditions to the hearth and bosh. Importance of the ratio of coke ash slag constituents to slag constituents of ore mix is stressed.

SECTION II

SMELTING AND REFINING

2-1. **Fluxing Aluminum and Its Alloys.** James L. Erickson. *Western Metals,* v. 2, Dec. '44, pp. 26, 28, 31.

Degassers; refining fluxes; modification; general remarks. 20 ref.

2-2. **Magnesium in the Pacific Northwest.** Nathanael H. Engle. *Western Metals,* v. 2, Dec. '44, pp. 41-42.

Developed by the Electro Metallurgical Co. and used to a limited degree before the war, process is differentiated from the Pidgeon process by the type of furnace used. Spokane operation uses electric refractory furnaces, each of which has a capacity approximately equivalent to 100 retorts. Calcined dolomite and ferrosilicon are used in each process, but the much larger furnace units greatly increase economy of operation.

2-3. **Quasi-Bessemerising Process.** W. S. Williams. *Iron & Steel,* v. 17, Dec. '44, p. 714.

Silicon and phosphorus as controls of the graphite "throw."

2-4. **Quality Steels—Today and Tomorrow; Present Steelmaking Processes.** Earle C. Smith. *Metal Progress,* v. 47, Jan. '45, pp. 79-82.

Description of the producing units serves as a foundation for the comparison of their usefulness.

2-5. **Quality Steels — Today and Tomorrow; Future Changes Reasonably to Be Expected.** H. B. Emerick. *Metal Progress,* v. 47, Jan. '45, pp. 82-83.

Ore supplies and influence on iron smelting. Bessemer and electric processes. Constantly increasing uses for modernized instrumentation, automatic control systems, and broader metallurgical control of all iron and steel making operations.

2-6. **Developments in the Production and Technology of Magnesium and Its Alloys.** F. A. Fox and G. Goddard. *Metallurgia,* v. 31, Dec. '44, pp. 70-74.

Consideration given to the main developments in magnesium technology during 1944, both in England and abroad; extraction process development; fabrication process development; engineering process development; research developments. 51 ref.

2-7. **Electric Furnace Alloy Steel Plant Expanded by A. M. Byers Company.** *Industrial Heating,* v. 12, Jan. '45, pp. 71-72, 74, 76, 78, 80, 82, 104.

Alloy steel production facilities at this plant have been expanded by the installation of additional electric arc furnace capacity, along with auxiliary equipment. A general view of the present plant interior is shown.

2-8. **Recent Metallurgical Developments in Steelmaking.** H. B. Emerick. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 96-99.

Steel making capacity in the United States is now rated at 94,054,550 net tons of steel ingots and castings per year. Blast furnace capacity for producing pig iron and ferro-alloys is rated at 68,446,310 net tons annually. Hot metal; temperature control; segregation problems; deoxidation and slag control; alloy steels; National Emergency steels; needled steels; hardenability bands.

2-9. **Basic O. H. Slags.** Brian Mason. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 770-773.

Determination of their chemical composition and constitution.

2-10. **Ironmaking.** *Iron & Steel,* v. 17, Dec. 7, '44, pp. 806-809.

Practice and development at Appleby-Frodingham.

2-11. **Blast-Furnace Practice.** *Iron & Steel,* v. 17, Dec. 7, '44, pp. 809-820.

Abridged report. Introduction; fuel consumption and economy; furnace operation and problems; preparation of the burden; furnace and stove refractories.

2-12. **Operates Open Hearths on All Scrap-Carbon Charge.** Paul S. Kingsley. *Steel,* v. 116, Jan. 22, '45, pp. 106-107, 109.

Practice in cold-iron shops particularly when cheap scrap is available affords low mix costs. Sulphur kept within bounds by the use of spiegel or the charging of high-manganese crops. Sequence of charging parallels conventional method. Control of shop operations similar to that applicable to pig-scrap charge.

2-13. **Effects of Water Vapor, Carbon Reactions and Temperature in Brass and Bronze Melting.** H. L. Smith. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 846-853.

Solubility of hydrogen; effect of carbon monoxide and carbon dioxide; furnace atmospheres; melting conditions.

2-14. **Copper and Copper Alloys.** G. L. White. *Canadian Metals and Metallurgical Industries,* v. 8, Jan. '45, pp. 14-19.

Outlines briefly the manufacturing processes involved in the production of primary brass and copper materials.

2-15. **The Possibility of Gas Saving (During the Smelting of Metals) in a Smelter.** Gottlieb Eisenmann. *Die Giesserei,* v. 31, Jan. '44, pp. 8-11.

Factors controlling the industrial application of gas are investigated. Advantages of preheating the air.

2-16. **Steel Ingots.** E. Barber. *British Steelmaker,* v. 11, Jan. '45, pp. 14-18.

Solidification of steel; cooling of steel; reducing segregation; methods of ingot casting; advantages of bottom pouring; top pouring; steel classification; the nozzle.

2-17. **Control of the Acid Open Hearth by Means of Slag Fluidity Tests.** G. R. Fitterer. *British Steelmaker,* v. 11, Jan. '45, pp. 29-33.

Deals specifically with a search for the equilibrium which the acid open-hearth reputedly approaches. (Reprinted from *Iron Age,* Oct. 26, '44.)

2-18. **The Electrochemistry of the Dow Magnesium Process.** Ralph M. Hunter. Electrochemical Society Preprint no. 86-30, Oct. '44, 12 pp.

Drying of magnesium chloride from liquors to cell feed described; factors affecting the choice of fused-salt bath compositions discussed, and it is pointed out that the selection cannot be made from an electrochemical standpoint only, but that the impurities present in the raw materials must be considered. Various impurities enumerated, and their effects on the process and products traced, particularly the effects of impurities found in sea waer, which were not encountered in Michigan brines.

2-19. **Further Studies of Functions of Chloride in Copper Refining Electrolyte: Bismuth.** Yu-Lin Yao. Electrochemical Society Preprint no. 87-2, April '45, 8 pp.

Increasing the chloride concentration in a copper refining electrolyte up to about 15 mg. per liter decreases the tendency for the codeposition of bismuth with copper. The beneficial effect is greatest at the critical chloride concentration. Above the critical concentration this beneficial effect still exists but is less pronounced. A working hypothesis is proposed to account for these phenomena and the chief functions of chloride in copper refining electrolyte are summarized.

2-20. **Extraction of Pure Cobalt by Electrolysis.** N. Fedotov. Electrochemical Society Preprint no. 87-3, April '45, 3 pp.

Starting with a crude cobalt oxide cake, this is converted into cobalt sulphate and electrolyzed in a diaphragm cell, using Duriron anodes. Catholyte and anolyte are separately circulated and regenerated. Excess iron in the anolyte is removed by soda ash, and nickel in the catholyte by dimethylglyoxime, thus keeping these impurities very low in concentration. The cathode deposit analyzed 99.9% Co, 0.02% Fe, and 0.05% Ni.

2-21. **Recent Developments and Trends in Melting, Refining and Casting.** *Metals and Alloys,* v. 21, Jan. '45, pp. 110-113.

General trend in the processing of liquid metals, and individual reviews of each important industrial metal melting and metal casting field.

2-22. **The Lead Industry.** R. A. Perry. *Mining and Metallurgy,* v. 26, Feb. '45, pp. 66-67.

Progress made in certain features of smelting and refining practice.

2-23. **Non-Ferrous Physical Metallurgy.** Michael B. Bever and Carl F. Floe. *Mining and Metallurgy,* v. 26, Feb. '45, pp. 90-96.

Advances in processing, fabrication, and surface treatment.

2-24. **Slag Systems.** Helen Towers and Jan M. Dworek. *Journal of the West of Scotland Iron and Steel Institute,* v. 51, Part 6, 1943-44, pp. 123-132.

Viscosity determinations of the system MnO-Al_2O_3-SiO_2.

2-25. **Melting Aluminum.** Hiram Brown. *Modern Metals,* v. 1, Feb. '45, pp. 16-20.

Melting of aluminum preparatory to casting. Handling the metal, composition characteristics, furnaces used, melting, combustion gases and their effect on the metal, proper melting temperature control and fluxing.

2-26. **Magnesium from Dolomite.** W. M. Pierce, R. K. Waring, L. D. Fetterolf and G. T. Mahler. *Metal Industry,* v. 66, Jan. 26, '45, pp. 50-52.

Phases of general interest, of an extensive investigation carried out by the New Jersey Zinc Co. on the Pidgeon process for the manufacture of magnesium. (Presented to the American Institute of Mechanical Engineers.)

2-27. **Magnesium from Dolomite.** W. M. Pierce, R. K. Waring, L. D. Fetterolf and G. T. Mahler. *Metal Industry,* v. 66, Feb. 2, '45, pp. 69-70.

Some developments in the ferrosilicon process; effects of briquette size, degree of vacuum, silicon efficiency, retort life, condensation and the charging and discharging processes.

2-28. **Electrolytic Manganese, I.** *Metal Industry,* v. 66, Feb. 16, '45, pp. 101-102.

Production efficiency; crystal structure; future possibilities. 6 ref.

2-29. **Review of Slag Control in 1944; Part II.** W. O. Philbrook. *Industrial Heating,* v. 12, Feb. '45, pp. 262, 264, 266.

Slag-control programs as practiced in Wisconsin Steel Works, International Harvester Co., Chicago, and numerous plants from which data were available.

2-30. **Melting and Evaporating Metals in a Vacuum.** W. J. Kroll. Electrochemical Society Preprint 87-6, April 16, '45, 14 pp.

Factors involved in the melting and evaporation of metals at reduced pressures, and resulting lower temperatures discussed. Evaporation-condensation upward and downward from solid and from liquid states considered. Purification of metals and recovery of a metal from an alloy by vacuum distillation are discussed. Data on evaporation temperatures for various conditions at reduced pressures are tabulated. 29 ref.

2-31.* **The Effect of Deoxidation Procedure on the Properties of Chill-Cast Tin Bronze Melted Under an Oxidizing Flux.** W. T. Pell-Walpole. Institute of Metals *Journal*, v. 71, Jan. '45, pp. 37-44.

Additions of phosphorus or aluminum or both were made before or after removing the flux from the molten metal. Deoxidation with phosphorus is fully effective, giving maximum density and mechanical properties, irrespective of the stage in the melting at which the addition is made, provided sufficient is added to insure a residual content of about 0.02% in the bronze. If the phosphorus is added before removing the flux, a considerable proportion is absorbed by the latter. Deoxidation with aluminum gives higher densities than phosphorus does, but inferior mechanical properties owing to entrapped oxide films. These occur most extensively in ingots deoxidized after removal of the oxidizing flux. The use of phosphorus together with aluminum does not eliminate the disadvantages of the latter and leads to no improvement in properties. 4 ref.

2-32. **Bessemer Steel Production and Application.** *Iron Age*, v. 155, March 22, '45, pp. 59-65.

Production and characteristics of killed bessemer steel; dephosphorized bessemer steel used for many products; future of bessemer steel for automatic screw machine products; conveyor degreaser made fire-safe.

2-33. **Metallurgy of Liquid Steel.** B. B. Rosenbaum. *Industrial Heating*, v. 12, March '45, pp. 438, 440, 442, 444, 446.

Part II: Physico-chemical considerations and slag control.

2-34. **Modern Blast Furnace Design and Operation.** James Dale. *Blast Furnace and Steel Plant*, v. 33, March '45, pp. 360-365.

Available volume between small and large bell; angle of large bell; McDonald deflector or distributing ring.

2-35. **The Effect of Melting Practice on the Properties of Steel.** J. A. Preston. *Blast Furnace and Steel Plant*, v. 33, March '45, pp. 366-368, 383.

Factors governing quality; oxidation; refining. (Paper delivered before the Australian Institute of Metals, Melbourne Branch, May 4, '44, and printed in *The Australian Engineer*.)

2-36. **Non-Ferrous Metal Melting.** Davidlee Von Ludwig. *Industrial Gas*, v. 23, March '45, pp. 9-12.

Comparison of test bar castings made in oil and gas-fired crucible furnaces.

2-37. **Miniature Smelting.** G. H. Goodwin. *Iron & Steel*, v. 18, Jan. '45, pp. 6, 17.

Working model blast furnace.

2-38. **Blast Furnace Gas—Wet-Washed or Dry-Cleaned?** F. X. Gilg. *Iron and Steel Engineer*, v. 22, March '45, pp. 47-54.

Experience indicates that wet-washed gas, unless cleaned to 0.02 grain per cu. ft. or less, leaves deposits in the boiler which are more troublesome than those resulting from dirtier dry-cleaned gas.

2-39. **Blast Furnace Tuyeres.** J. B. Fortune. *Iron & Steel,* v. 18, Jan. '45, pp. 7-9.

Methods of increasing life and overcoming abnormal losses.

2-40. **The Blast Furnace Skip Hoist, II.** Gordon Fox. *Iron and Steel Engineer,* v. 22, March '45, pp. 55-61.

Paper relates to adjustable-voltage control for blast furnace skip hoists.

2-41. **Steel Ingots.** *Iron and Steel,* v. 18, Feb. '45, p. 50.

Maintenance of uniform teeming speeds.

2-42. **West Coast Steel Mill.** G. Eldridge Stedman. *Steel,* v. 116, April 2, '45, pp. 120, 123, 126.

Features efficient open-hearth practice at Columbia Steel plants.

2-43. **Sponge Iron—a Progress Report.** *Steel,* v. 116, April 9, '45, pp. 106-108, 148, 151-152, 154, 156.

Improved utilization of domestic iron, manganese and chrome ores. 8 ref.

2-44. **Preparation of Ultra-Pure Cartridge Brass.** J. L. Rodda. *Metal Progress,* v. 47, March '45, pp. 505-507.

Describes the preparation of brass made from spectrographically pure zinc and copper of comparable purity under conditions which did not introduce any impurities, but may actually have accomplished some purification, particularly in regard to gas content and oxide films.

2-45. **Slag Control.** N. H. Bacon. *Iron and Steel,* v. 18, March '45, pp. 86-90.

Making high grade steel is a matter of skill and experience but is facilitated by scientific control. Methods for adjusting the silica, phosphorus and sulphur in the bath.

2-46. **Steel Ingots.** B. M. Larsen. *Iron and Steel,* v. 18, March '45, pp. 91-96, 100.

Crystallization in a steel ingot depends upon a number of factors such as the shape of the mold, the temperature difference between the metal, the mold and the surroundings, and the composition of the steel. Effect of some of these factors on the final structure. (American Institute of Mining and Metallurgical Engineers.)

2-47. **Steel Ingots, III.** E. Barber. *British Steelmaker,* v. 11, March '45, pp. 122-126.

Difficulties with rimming steels; surface finish; causes of surface flaws; mold design; ingot structures; form of corrugations; mold taper; maintaining contact.

2-48. **New Type Ladle Nozzle.** *Steel,* v. 116, April 16, '45, p. 130.

Affords uniform pouring speed.

2-49. **Controlling Gases in Open Hearth Steel.** A. Floyd Whalen and James Nagy. *Blast Furnace & Steel Plant,* v. 33, April '45, pp. 446-448, 476.

Gases considered are those which are trapped upon solidification of the metal. These gases are formed while the molten metal remains in the furnace, and

they can be controlled by temperature regulation, ladle additions, holding heat in ladle and pouring practice.

2-50. **Ladle Deoxidation in Steel Production.** *Blast Furnace & Steel Plant,* v. 33, April '45, pp. 469-474.

Impurities in a heat of steel removed by oxidation. Furnace, ladle, and mold additions of various deoxidizing agents perform this function, but react with the FeO in the metal and produce non-metallic inclusions in the heat. Control of the FeO content of the bath prior to deoxidation, through slag control, is fundamental, since by keeping the FeO content low the quantity of deoxidizing agents required is reduced. Discussion of the use of Simanal as a deoxidizer in various steels.

2-51. **Magnesium Production—I.** D. D. Howat. *Chemical Age,* v. 52, March 17, '45, pp. 237-243.

Developments in thermal reduction processes.

2-52. **Magnesium From Olivine.** E. C. Houston. *Metals Technology,* v. 12, April '45, T.P. 1828, 14 pp.

Describes a process developed through the pilot-plant stage, whereby magnesium chloride suitable for reduction to metallic magnesium can be prepared from olivine by extraction with hydrochloric acid and subsequent purification. 13 ref.

2-53. **Production of Magnesium at Painesville, Ohio.** J. M. Avery and R. F. Evans. *Metals Technology,* v. 12 April '45, T. P. 1829, 8 pp.

Production of magnesium by the electrolytic process, using steam-electric power supplied by a public utility.

2-54. **The Plant of the Dow Magnesium Corp. at Velasco, Texas.** C. M. Shigley. *Metals Technology,* v. 12, April '45, T.P. 1845, 9 pp.

Unquestioned weight advantage of the magnesium alloys, coupled with their ease of fabrication and good corrosion resistance, make the future of magnesium look very bright. Past struggle will be considerably eased by the well-demonstrated feasibility of its recovery from sea water. 5 ref.

2-55. **Pilot-Plant Production of Electrolytic Magnesium From Magnesia.** R. R. Lloyd, C. K. Stoddard, K. L. Mattingly, E. T. Leidigh, and R. G. Knickerbocker. *Metals Technology,* v. 12, April '45, T.P. 1848, 25 pp.

Magnesium cell can be operated continuously at a reasonable current efficiency. $MgCl_2$ concentration in the electrolyte must be maintained above 55% to permit desired suppression of chlorine. Major cause of sludge formation in the cell is ascribed to plating out of colloidal MgO at the cathode. Presence of iron in the bath results in the plating out of metallic iron on the magnesium globules formed at the cathode. 18 ref.

2-56. **Investigations on the Recovery of Vanadium From Slags.** J. Klarding. *Archiv fur das Eisenhüttenwesen,* v. 17, Jan.-Feb., '44, pp. 153-157. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 121-A.

The influence of the form of pretreatment and of

the chemical composition of vanadium slags on the facility with which the vanadium can be leached out with acids was investigated. The amount leached out was increased by raising the temperature of the roasting pretreatment and by increasing the proportion of silica in the slag mix before roasting.

2-57. **Melting and Pouring for Magnesium and Aluminum Alloys.** Alexander McIntosh. *Aluminum & Magnesium,* v. 1, April '45, pp. 16-19, 33-34.

Care of furnace; melting; stirring; after stirring; dusting; fluxes; melting and pouring of aluminum alloys; procedure for melting aluminum; standard pouring procedure for all metals.

2-58. **Magnesium Production, II.** D. D. Howat. *Chemical Age,* v. 52, March 24, '45, pp. 259-264.

Developments in thermal reduction processes. 15 ref.

2-59. **Acid Steel Castings.** *Canadian Metals & Metallurgical Industries,* v. 8, April '45, pp. 42, 46.

Melting and molding practice at Vulcan Iron Works.

2-60. **Slag Control.** N. H. Bacon. *Iron & Steel,* v. 18, April '45, pp. 124-127.

Improving basic open-hearth furnace performance. 9 ref.

2-61. **Steel Ingots, IV.** E. Barber. *British Steelmaker,* v. 11, April '45, pp. 166-171.

Why ingots are tapered; extent of taper; ingot length; pouring hints; mold coatings; ladle influence; mold bottoms; preheating the ingot; the feeding head casing; ingot reduction; extent of reduction.

2-62. **Charging Electric Steel and Other Furnaces.** *British Steelmaker,* v. 11, April '45, pp. 176-178.

To accomplish furnace charging quickly, mobile type box chargers have been developed. (*Metallurgia,* v. 31, March '45, p. 257.)

2-63. **Melting 80% Ferromanganese in Cupolas.** John Howe Hall. *Foundry,* v. 73, May '45, pp. 107, 195-196, 198, 200.

Description of development of the process.

2-64. **Soda Briquettes in the Steel Industry.** *Chemical Age,* v. 52, April 7, '45, pp. 312-313.

Sulphur reduction in iron.

2-65. **Eastern Open-Hearth Steelmakers Discuss Operating Problems.** *Steel,* v. 116, April 30, '45, p. 102.

Scheduling furnaces for rebuilds; bottom repairs; tap hole repair; method of storing brick; furnace control equipment; fuel burners; colloidal fuel; deoxidation; pit practice; cleanness of killed steel.

2-66. **Making Swedish Pig Iron.** R. P. Donogh and D. B. Stough. *Foreign Commerce Weekly,* v. 19, May 12, '45, pp. 10-13, 47-50.

Growth of iron industry; early production processes; introduction of pig iron; Elektrometall furnace; other electric furnaces; grades of pig iron; direct reduction processes; ferro-alloys; wartime developments; wartime cost increases.

2-67. **New Developments in Aluminum and Magnesium Furnace Design and Melting Practices.** Arthur D. Wilcox. *Industrial Gas,* v. 23, May '45, pp. 9-12, 27-28.

Information on the general procedures of the various melting methods and to indicate the problems involved in melting aluminum and magnesium with gas.

2-68. **Melt Control, Its Evolution and the Effect of a Current Control Method on Basic Open Hearth Operations.** A. M. Kroner. *Blast Furnace & Steel Plant,* v. 33, May '45 pp. 561-567.

Early melt control practice; hot metal mixers; early high metal practice; calculated correction for hot metal silicon analysis; iron-scrap ratio control; development of current practice; results of current practice.

2-69. **Influence of Melting Conditions on the Physical Properties of Steel Castings.** H. T. Protheroe. Paper presented to the Iron & Steel Institute, London, August '44, *Engineers' Digest* (American Edition), v. 2, May '45, pp. 248-249.

Factors which have the most decided influence upon the mechanical properties of the final product. Four groups of cast steels with carbon contents of (1) below 0.2%, (2) 0.2 to 0.23%, (3) 0.24 to 0.26%, and (4) over 0.26% were investigated.

2-70. **The Movement of Slag Particles in Liquid Steel.** F. Hartmann. *Stahl und Eisen,* v. 65, Jan. 18, '45, pp. 29-36. Iron and Steel Institute *Bulletin,* no. 112, April '45, pp. 149-A-150-A.

2-71. **The Constitution of Basic Steel Furnace Slags.** J. R. Rait and H. J. Goldschmidt. Iron & Steel Institute, Advance Copy, April '45, 68 pp.

Systems of phase assemblages were deduced from the available phase-diagram data for basic electric reducing and oxidizing slags and basic open-hearth slags. Constitutions of these slags were calculated and compared with the constitutions determined by the X-ray powder method. Agreement between the theoretical and observed results indicates that the systems of phase assemblages are essentially correct. 62 ref.

2-72. **A Study of the Basic Open-Hearth Process, With Particular Reference to Slag Constitution.** A. H. Jay. Iron & Steel Institute, Advance Copy, April '45, 32 pp.

Experiments carried out to investigate the constitution of basic open-hearth slags in relation to the mechanism of dephosphorization in the furnace and rephosphorization in the casting pit. Work involved X-ray examination and chemical analysis of slag samples taken during the refining period and the casting of the ingots.

2-73. **The Phosphorus Reaction in Basic Open-Hearth Practice.** Y. K. Zea. Iron & Steel Institute. Advance Copy, April '45, 46 pp.

Practical applications of the equations for calculating the phosphorus content of the metal on the basis of the slag composition and the bath temperature, established by four investigators, are examined in relation

to new temperature data and slag and metal analyses obtained from fifteen casts of basic open-hearth steel. It is found that Schenck and Riess's method gives the best results. Results show that rephosphorization during casting is due to a change in the composition of the slag by enrichment of the silica content resulting from its reaction with the fireclay lining of the ladle. 31 ref.

2-74. **Magnesium Technology.** *Chemical Industries,* v. 56, June '45, pp. 978, 980, 1057.

Resume of magnesium production methods that have been used commercially during the present war.

2-75. **Magnesium Fluxes.** A. W. Brace. *Metal Industry,* v. 66, May 4, '45, pp 274-275.

Magnesium is invariably melted under a flux, and these fluxes always contain magnesium chloride. Reasons for this given and the mechanism of their action further discussed, with special reference to some patented compositions. 9 ref.

2-76. **Electric Steel.** *Iron and Steel,* v. 18, May '45, pp. 156-157.

Methods and equipment for furnace charging.

2-77. **Establishing Basic Open Hearth Practice for Optimum Chromium Practice.** R. G. Waite. *Blast Furnace & Steel Plant,* v. 33, June '45, pp. 708-711.

The variables and other theories which affect the melting loss of chromium and the recovery of chromium from the furnace additions are: Chromium content of the slag prior to ferrochrome addition; degree of deoxidation; basicity of the slag before FeCr addition; time for chromium distribution between slag and bath; point of addition of FeCr in the furnace log; preheat of ferrochrome; amount of carbon, manganese, and alloy in the bath at point of ferrochrome addition. 2 ref.

2-78. **The Improvement of the Citric-Acid Solubility of Basic Open-Hearth Slags Containing Fluorspar.** T. F. Pearson. Iron & Steel Institute, Advance copy, May '45, 13 pp.

Brief mention is made of the citric-acid solubility test for basic slags. A survey of the order of solubility for slags from both fixed and tilting furnaces when fluorspar is used follows. Tapping-slags were found to be 10 to 20% soluble for fixed furnaces and 20 to 30% soluble for a tilting furnace with current practice. Severity of the quench appeared to influence the results. Further work in the laboratory involved the sintering of powdered low-solubility slags with sodium carbonate and other sodium compounds. 4 ref.

2-79. **"Kish—Excess Carbon."** M. L. Carl. *Pig Iron Rough Notes,* no. 99, Spring-Summer, '45, pp. 23-25.

Amount of carbon an iron can hold in solution at a given temperature is dependent upon the amounts of other elements present, particularly silicon. High silicon iron can hold less carbon in solution at a given temperature than a low silicon iron at the same temperature. Addition of steel or alloys to the charge of

molten iron changes balance almost in proportion to the amounts added.

2-80. **Clean Steel.** *British Steelmaker,* v. 11, June '45, pp. 261-266.

Test to show the influence of non-metallics will not be a good one because: (1) The influence of non-metallics cannot be separated from other concurrent influences, and (2) it is not possible to take a sample.

2-81. **Trial Run Is Made at Sponge Iron Plant.** *Steel,* v. 116, June 25, '45, pp. 122-123, 166, 170.

Experimental ore reduction unit sponsored by War Production Board and located at Warren, Ohio, plant of the Republic Steel Corp., produces 400 tons of product. History, description and status of project.

2-82. **Hydrogen Content of Electrolytic Manganese and Its Removal.** E. V. Potter, E. T. Hayes and H. C. Lukens. *Metals Technology,* v. 12, June '45, T.P. 1809, 9 pp.

Investigation to determine amount of hydrogen or other gases in typical commercial electrolytic manganese sheet and to investigate ways of removing it most conveniently. 4 ref.

2-83. **Metal Recovery by Anion Exchange.** Sidney Sussman, Frederick C. Nachod and William Wood. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, July '45, pp. 618-624.

Anion exchange for recovery of metals which form complex anions. Satisfactory absorption and recovery have been demonstrated with chromium, gold, iron, molybdenum, palladium, platinum, and vanadium, using different types of complex anions. A more extensive study was made of chromium recovery. The anion exchange mechanism of the adsorption was demonstrated. Adsorption on different anion exchanger salts and from several influents was carried out. Best results were obtained with adsorption from a neutral chromate solution on the anion exchanger chloride. 29 ref.

2-84. **The Oxidation and Evaporation of Magnesium at Temperatures from 400° to 500° C.** Earl A. Gulbransen. Electrochemical Society, Preprint 87-33, 11 pp.

Vacuum microbalance technique is used for the study of the oxidation and evaporation of magnesium at temperatures from 400 to 500° C. and at several pressures. The curves obtained consist of an initial evaporation period, an oxidation period, and a final evaporation period. The oxidation curves at temperatures of 475° C. and higher are linear with time of oxidation.

2-85. **Alsifer and How to Use It.** *Vancoram Review,* v. 4, Spring '45, pp. 16-17.

What Alsifer is; melting temperature; density; purity; deoxidizing power; products of deoxidation; grain size control; general; open hearth; electric furnace.

2-86. **Magnesium by the Carbothermic Process.** Gerald E. Stedman. *Metals & Alloys,* v. 22, July '45, pp. 102-106.

Calcined dolomite converted to magnesia and the

latter reduced by carbon while heated in low pressure or vacuum retorts. Comprehensive description of Kaiser's plant and process at Permanente.

2-87. **Zinc Recovery.** W. T. Isbell and C. C. Long. *Metal Industry*, v. 67, July 6, '45, pp. 7-8.
Direct production of metal from lead blast furnace slag.

2-88. **Basic Slags and Dephosphorization.** Frank G. Norris. *Metal Progress*, v. 48, Aug. '45, pp. 291-296.
Review of: The Constitution of Basic Steel Furnace Slags, by J. R. Rait and H. J. Goldschmidt; A Study of the Basic Open-Hearth Process, With Particular Reference to Slag Constitution, by A. H. Jay; The Phosphorus Reaction in Basic Open-Hearth Practice, by Y. K. Zea.

2-89. **Process Control in the Production of Sulphur Steel.** G. A. Ferris and H. Clark. *Iron & Steel Engineer*, v. 22, July '45, pp. 37-45.
Benefits derived from a controlled process of manufacture in producing semi-finished billets of low carbon free-cutting steels in the open-hearth. The relative importance of open-hearth, soaking pit, and blooming mill practice is discussed.

2-90. **Vacuum Metallurgy.** W. J. Kroll. *Canadian Metals & Metallurgical Industries*, v. 8, July '45, pp. 26-30.
Methods and applications of melting and evaporating metals in a vacuum. 29 ref.

2-91. **Effect on Yield of Medium Carbon, Semi-Killed Steel.** E. C. Sorrells. *Blast Furnace & Steel Plant*, v. 33, July '45, pp. 843, 848.
Factors which affect surface and yield of medium carbon, semi-killed steel are: Melting and deoxidation to obtain proper ingot structure and surface, sulphur content, mold design, temperature and rate of pour, proper soaking pit heating practice. Uniform results can be obtained in ingot structure from heat to heat if melt carbon, slag control, carbon drop, temperature at tap, carbon at tap, amount of deoxidizer used in teeming are controlled.

2-92. **Method for Producing Low Carbon Pig Iron.** A. Denison Williams. *Blast Furnace & Steel Plant*, v. 33, July '45, pp. 849-851.
Conventional circular blast furnace is converted to produce low carbon pig iron.

2-93. **Open-Hearth Furnace Operation and Maintenance, II.** *Industrial Heating*, v. 12, July '45, pp. 1200, 1202, 1204.
Substitutes for fluorspar and the use of cupola iron in the open-hearth charge.

2-94. **Application of pH Slag-Basicity Measurements to Basic Open-Hearth Phosphorus Control.** Michael Tenenbaum and C. C. Brown. *Metals Technology*, v. 12, Aug. '45, T.P. 1863, 10 pp.
Factors considered in applying the pH measurements to actual slag control and some of the results of its application.

2-95. **Effect of Ingot Delivery Time as a Factor in Quality of Bessemer Steel.** Howard C. Dunkle. *Metals Technology,* v. 12, Aug. '45, T.P. 1878, 10 pp.

Apparent similarity of the frequency-distribution curves for blows with and without rejections shows how little one factor can account for steel quality. Effect of finish strip to finish charge time is considerably more important than the ingot delivery time for the same length of time. Best quality for high sulphur steels (B1112, B1113, and C1117) is obtained when the ingot delivery time is the shortest, or from ingots charged into the pits as cold steel. 5 ref.

2-96. **The Mechanical Phase of Open-Hearth Steel Manufacture.** Folke Sundblad. *Iron & Steel Engineer,* v. 22, Aug. '45, pp. 51-58.

Improvement in the mechanical factors of the open-hearth process has given marked operating economies. The unstable relation between the prices of scrap and pig iron act against new charging methods which might lead to heavier scrap charges.

2-97. **The Blast Furnace Burden.** Theodore Powell. *Metallurgia,* v. 32, July '45, pp. 121-125.

Economical production of good quality steel depends to a large extent on the production of suitable irons from the blast furnace and, while many factors in the furnace operation influence the economical production of suitable irons, the burdening of the furnace probably has the most important influence. The blast furnace determines the character and quality of the pig iron produced, thus it has a direct influence on the costs incurred in producing steel. Discusses the subject in relation to steel-works requirements and the ideal burden.

2-98. **Ferro-Alloys Used in Steel Making.** *Metals & Alloys,* v. 22, Aug. '45, pp. 455, 457.

Commercial forms and uses; summary of specifications for ferro-alloys.

2-99. **Deoxidizing a Heat of Acid Electric Steel.** Conrad C. Wissmann. *Metal Progress,* v. 48, Sept. '45, pp. 499-504, 530.

Confined to the means a melter has of cleaning the steel of the impurities which are in it before it is tapped; carbon the best deoxidizer.

2-100. **The Production of Magnesium, Part II.** *Industrial Chemist,* v. 21, Aug. '45, pp. 419-426.

Survey of the process developed by Magnesium Elektron, Ltd. Proportioning; chlorinator house; charging; hydrochloric acid recovery; cell house; neutralization house; research laboratories.

2-101. **Slags and Slag Control in Basic Open-Hearth Furnaces Using Phosphoric Iron.** *Industrial Heating,* v. 12, Aug. '45, pp. 1352, 1354.

Illustrates the chronological development of a slag control method, designed first for use during refining, but subsequently enlarged to embody also the charging of lime in furnaces using high percentages of molten phosphoric iron.

2-102. **Considerations on Blast Furnace Practice.** T. P. Colclough. *Blast Furnace & Steel Plant,* v. 33, Sept. '45, pp. 1101-1105.

Efficiency of carbon in the furnace; conditions for equilibrium; application of carbon-efficiency principles; reduction of heat requirement in the blast furnace.

2-103. **Beryllium and Its Alloys.** W. J. Kroll. *Metal Industry,* v. 67, Sept. 7, '45, pp. 148-149.

Production of beryllium metal and its alloys is one of the most difficult tasks in metallurgy. Examines the progress made in this work in the last 15 years, taking into account the outstanding publications, including those of the patent literature, and the information obtained during 20 years experience with this metal. (Bureau of Mines Information Circular 7326.)

2-104. **Spiegeleisen, Its History, Uses and Purpose.** S. E. Maxon, *Steel,* v. 117, Sept. 17, '45, pp. 138, 140, 172, 174.

Iron-manganese alloy produced in this country for past 90 years is available in three grades, all low in phosphorus and varying in manganese and silicon contents. Product finds wide application in acid and basic open-hearth shops for recarburizing and reboiling and for blocking carbon content of heat; also helpful in gray iron and malleable practice.

2-105. **Zinc Smelting and Refining.** W. H. Dennis. *Mine & Quarry Engineering,* v. 10, Sept. '45, pp. 211-220.

Review of present-day practice with special note on the use of refractories.

2-106. **Beryllium and Its Alloys.** W. J. Kroll. *Metal Industry,* v. 67, Sept. 14, '45, pp. 167-168.

Examines and critically analyzes the processes available for the manufacture of beryllium alloys, including their preparation direct from the ore.

2-107. **Determining Lime-Silica Ratios for Open-Hearth Control by Mathematical Computation Using FeO and Fe_2O_3 Values.** John S. Coulter. *Blast Furnace & Steel Plant,* v. 33, Oct. '45, pp. 1242-1247.

Outlines the development and describes the method for slag control work, where rapidity in determining an accurate lime-silica ratio is necessary.

2-108. **Considerations on Blast Furnace Practice, Part II.** T. P. Colclough. *Blast Furnace & Steel Plant,* v. 33, Oct. '45, pp. 1253-1257.

Sintering; effect of slag volume on coke consumption; acid burdening; ore beneficiation; relation between size of ore and carbon for reduction.

2-109. **Wartime Changes That Will Affect Peacetime Steelmaking.** Frank G. Norris. *Metal Progress,* v. 48, Oct. '45, pp. 631-637.

Improvements in low grade ore beneficiation will keep pace with the depletion of our high grade deposits. Design of open-hearth furnace is becoming stabilized; trend noted toward use of oil for fuel and refractories containing synthetic magnesia. Aluminum ladle additions have replaced wartime use of borax, because of cheapness and

additional desirable effects. Improvements in the refining stage await better pyrometry.

2-110. **Acid Electric Process for Steel Castings.** John Juppenlatz. *Metal Progress,* v. 48, Oct. '45, pp. 638-641.

Steel foundry practice (3 to 5-ton furnaces). Important trend is toward ample transformer capacity, up to 100 kva. per sq.ft. of hearth. Roof life improved by better grade of silica brick, more carefully laid and preheated, and kept hot when furnace is idling by auxiliary gas flame. All but universal features: Removable roofs for bucket charging; slag control by color *plus* Herty's viscosimeter; closer approach to equilibrium between slag and metal at end of refining period; better and more uniform steel.

2-111. **The Basic Electric Furnace for Steelmaking.** S. D. Gladding and H. C. Bigge. *Metal Progress,* v. 48, Oct. '45, pp. 642-651.

Physico-chemical principles of refining in 50 to 100-ton furnaces. Mechanical, operational and metallurgical considerations necessary for success of various duplex and triplex processes. Recommends 62% Al_2O_3 sillimanite brick made from calcined Indian kyanite as best improvement over silica roof brick. Detailed technique of ramming bottoms. Use of inert gas in furnace and ladle when making special high alloys. Accurate spectrographic analyses of alloys in 9 to 15 min.

2-112. **Mechanical Phase of Open-Hearth Steelmaking.** F. W. Sundblad. *Steel,* v. 117, Oct. 29, '45, pp. 125-126, 148.

Properly balanced and stable ratio between scrap prices and pig iron costs affords solution of charging problem at open-hearth shops. Scrap yard must become processing plant in the future by handling collection and preparation based on scientific surveys and mass machine technique.

2-113. **Furnace Operations and Steel Quality Discussed at Pittsburgh Conference.** Gerhard Derge. *Industrial Heating,* v. 12, Oct. '45, pp. 1780, 1782, 1784, 1786.

Automatic control of reversal; study of flame radiation; bath temperatures; pouring practice; molds and stools; steel quality.

2-114. **Lead Smelting.** W. H. Dennis. *Mine & Quarry Engineering,* v. 10, Oct. '45, pp. 237-243, 251.

Brief review of modern practice.

2-115. **Practice Followed in Use of Open-Hearth Charge Ores.** Clyde Denlinger. *Steel,* v. 117, Nov. 5, '45, pp. 148, 150, 188, 191.

Advantages and limitations of charge ores including soft fine, hard lump and briquetted ores, and nodules and sinter are considered. Use of wet ore is not recommended. Various combinations of these charging materials permit the use of certain percentages of pig iron in open-hearth heats.

2-116. **Influence of the Charge Upon Open-Hearth Furnaces.** H. F. Lesso and R. W. McCann. *Iron & Steel Engineer,* v. 22, Oct. '45, pp. 37-49.

Evaluates the effects of variations in the charge upon open-hearth performance.

2-117. **Talks About Steelmaking. Old Molds.** *British Steelmaker,* v. 11, Oct. '45, pp. 440-441.

The thoughts of 1940 to explain some of the puzzles of 1880.

2-118. **The Development of Electric Furnaces for Steelmaking.** Norman F. Dufty. *British Steelmaker,* v. 11, Oct. '45, pp. 442-445.

A historical outline of the development of the various types of electric furnaces.

2-119. **Reduction of Iron Ore in Clay and Steel Containers (Saggers).** J. P. Walker. Bureau of Mines Report of Investigations 3819.

Production of sponge iron in three sizes of clay refractory saggers and two sizes of low carbon steel containers; investigation of five types of desulphurizing agents and testing of four commercially available fuels as reducing agents.

2-120. **Production of Sponge Iron in a Shale-Brick Plant.** Donald W. Ross. Bureau of Mines Report of Investigations 3822.

Sponge iron comparable in quality to that made in the famous ceramic plants at Hoeganaes, Sweden, can be produced by carbon reduction in American common shale-brick plants. Experiments conducted at a New York State brickyard described.

2-121. **Determination of Metallic Iron and Oxygen in Sponge Iron.** J. P. Morris. Bureau of Mines Report of Investigations 3824.

Determination of the degree of reduction attained in the manufacturing process. Four methods for determining metallic iron and oxygen discussed—the mercuric chloride method, copper sulphate method, hydrogen reduction method, and hydrogen evolution method.

2-122. **Producing Sponge Iron in a Rotary Kiln.** T. L. Johnston. *Steel,* v. 117, Nov. 12, '45, pp. 128-129, 140, 142.

Pilot plant operated by Bureau of Mines at Laramie, Wyoming, employs coal to reduce iron in the ore to metallic form. Abrasive polishing treatment removes large percentage of impurities in granulated sponge iron. Charging and firing practices are being varied to afford lower cost of production. Details of equipment and process presented.

2-123. **Extracts from Notes on Basic Open-Hearth Plant and Practice.** J. McKay and W. G. Cameron. *Refractories Journal,* v. 21, Oct. '45, pp. 386-392.

Roof construction; quality of the refractory; furnace bottoms; back wall refractories; regenerators and slag pockets; rate of hydration; roof; burning in the bottom.

2-124. **Notes on Basic Open-Hearth Plant and Practice.** J. McKay and W. G. Cameron. West of Scotland Iron & Steel Institute *Journal,* v. 52, Part II, 1944-45, pp. 19-38.

Considers a few details of steelmaking. Furnace construction and melting shop arrangement included.

2-125. **Steelmakers Test Usefulness of Electrolytic Manganese.** R. T. C. Rasmussen and F. Sillers. *Steel,* v. 117, Nov. 19, '45, pp. 138, 140, 143, 188-191.

Absence of phosphorus and carbon in the pure metal facilitates meeting difficult specifications and affords larger charges of available alloy scrap. Product is handled conveniently and weight of additions calculated readily. Operators claim time saving when product is used in low carbon heats of open-hearth steel.

2-126. **Open-Hearth Practice in the Use of Cupola Hot Metal.** *Blast Furnace & Steel Plant,* v. 33, Nov. '45, pp. 1380-1384.

Three papers presented at a conference of the National Open-Hearth Committee of the AIME. I. Cupola Practice at Sheffield, by W. H. Steinheider. Open-hearth at Sheffield has two cupolas to supply hot metal. Description of one. II. Desulphurizing Cupola Iron With Soda Ash, by C. G. Hummon Describes desulphurizing in a 30-ton ladle and the removal of the slag by skimming before transferring the metal to the open-hearth. III. Use of Cupola Iron in the Open-Hearth, by W. H. Steinheider. Use of molten cupola iron is essentially the same as the use of molten pig iron. Time of charging is lessened and the speed of melting is increased to cut down the overall time consumed in making heats.

2-127. **Vacuum Metallurgy.** W. J. Kroll. *Metal Industry,* v. 67, Nov. 9, '45, pp. 295-297.

Factors involved in the melting and evaporation of metals at reduced pressures, and resulting lower temperatures. Effects of hydrostatic pressure of the molten metal, of metal-vapor pressure, and of residual-gas pressure on actual pressure and temperature at the point of evaporation are shown to be very important. (From Electrochemical Society.)

2-128. **Sinters Economize Blast Furnace Operation.** *Iron Age,* v. 156, Nov. 29, '45, pp. 62-63.

Reducibility tests and general survey of the physical and chemical changes involved together with more detailed study of special aspects of the process which seem to have an important bearing on the future development of blast furnace technique. (Paper for the Iron and Steel Institute.)

2-129. **Calcium.** P. H. Staub. *Metal Industry,* v. 67, Nov. 2, '45, pp. 285-286.

Discusses ferrosilicon process for production of calcium metal. (From *Chemical and Metallurgical Engineering.*)

2-130. **Fire Refining of Lead.** W. H. Dennis. *Mine & Quarry Engineering,* v. 10, Nov. '45, pp. 263-268, 272.

General outline of process; preliminary refining; softening; desilverization; chlorine dezincing; retorting and cupellation; continuous lead refining; removal of zinc.

2-131. **Effects of Deoxidation Practice.** *Steel,* v. 117, Dec. 3, '45, pp. 114-117, 154.

Studies of three carbon and six molybdenum steels indicate probable relationship between spheroidization and graphitization in presence of aluminum deoxidizing additions.

2-132. **Ore Reduction.** W. W. Fowler, J. W. Hanley and I. L. Barker. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 545-558.

Cerro de Pasco Copper Corporation. Copper and lead smelting, and copper, lead and zinc refining practice.

2-133. **Electrolytic Manganese Vs. Ferromanganese Addition Agents.** R. T. C. Rasmussen and F. Sillers. *Iron Age,* v. 156, Dec. 6, '45, pp. 80, 142.

Important advantages are high purity, smaller weight per addition and quicker dissolution in molten steel. Electrolytic metal is expected to compete with ferromanganese with lower price resulting from large scale production.

2-134. **Mechanized Mold Preparation.** *Western Machinery & Steel World,* v. 36, Nov. '45, p. 517.

New system uses less than half a pound of prepared coal tar pitch per ton of ingots. Operations given.

2-135. **The Manufacture of High Speed Steel.** W. H. Wills. *Steel Processing,* v. 31, Nov. '45, pp. 703-708.

Melting; hammer cogging; grinding; hot rolling; forging; annealing; cold drawing.

2-136. **Electrolytic Manganese in Stainless Steel Tests at Rustless Steel Corp. and Universal-Cyclops Steel Corp.** R. T. C. Rasmussen. Bureau of Mines Report of Investigations 3829.

Cooperative tests with two steel mills have disclosed that pure electrolytic manganese produced from low grade domestic ores in a Bureau of Mines pilot plant has definite advantages as a substitute for low carbon ferromanganese in the manufacture of stainless steels.

2-137. **Electric Furnace Operators Meet.** *Iron Age,* v. 156, Dec. 13, '45, pp. 75-78.

Sillimanite and magnesite sleeves and nozzles; production technique for stainless steels; top vs. machine charging basic arc electric furnaces. (Third annual Electric Furnace Steel Conference.)

SECTION III

PROPERTIES OF METALS AND ALLOYS

3-1. **Palladium.** *Electrochemical Society Bulletin,* Dec. '44, pp. 3-4.

Source and uses.

3-2. **Low-Alloy Cast Steels.** H. A. Schwartz and W. K. Bock. *Iron & Steel,* v. 17, Dec. '44, pp. 715-720.

Shows that tensile strength plotted against elongation gives a straight line, calculable from the chemical composition. This applies only to normalized or quenched steels, the latter tempered above 400° C. 4 ref.

3-3. **The Effect of Copper in Some NE and Low-Alloy Cast Steels.** C. T. Greenidge, M. C. Udy, and K. Grube. *Western Metals,* v. 2, Dec. '44, pp. 11-14, 16, 19-20.

In tests on four different alloy steels, three of which corresponded to NE grades, the presence of copper up to 50% did not change the tempering temperature required to obtain the desired hardness in full quenched specimens. When normalized, however, the steels showed a mild increase in as-normalized hardness as copper was raised from 0 to 0.50%. 9 ref.

3-4. **Non-Ferrous Metallurgy.** Bruce W. Gonser and R. I. Jaffee. *Iron Age,* v. 155, Jan. 4, '45, pp. 73-75, 180G-180H.

New alloys and improved surface treatments are winning the light metals an excellent postwar competitive position. The minor or unusual metals are enjoying a spurt in application, and new treatments for copper and new bronzes attract favorable attention.

3-5. **High-Strength Aluminum Alloys for Light Weight Structures.** Max E. Tatman and Roy A. Miller. *Product Engineering,* v. 16, Jan. '45, pp. 6-11.

To aid those who do not have the time to follow closely the new developments in materials, "super aluminum" alloys in general are discussed with emphasis on possible combinations, practical from a production standpoint, that achieve the best strength-weight ratios for light weight structures. Alloys and characteristics are compared and evaluated.

3-6. **New Aluminum Casting Alloys Strong as Cast.** Hiram Brown. *Metals & Alloys,* v. 20, Dec. '44, pp. 1616-1619.

Types of strong as-cast aluminum alloys in existence;

presents their properties and indicates their present and potential fields of application.

3-7. **Acid-Resisting Steels.** *Chemical Age,* v. 51, Dec. 2, '44, pp. 521-524.

Most important corrosion and acid resistant steels which today are employed in the chemical industry are shown. Also gives a review of their mechanical properties, structure and grain stability. Main constructional applications are for such purposes as vessels, plant, piping, etc.

3-8. **New Wrought Aluminum Alloys for Aircraft and New Temper Modification of Present Alloys.** Don A. Lawless. *Aeronautical Engineering Review,* v. 3, Dec. '44, pp. 25, 27, 29.

Properties and application possibilities of the new alloys and tempers reviewed briefly. 3 ref.

3-9. **Flow and Fracture.** P. W. Bridgman. *Metals Technology,* v. 11, Dec. '44, pp. 32-43.

Stress history; interconnection of flow and stress; stresses with two degrees of freedom; stress distribution at neck; fracture; McAdam's method.

3-10. **Conditions of Fracture of Steel.** J. H. Hollomon and C. Zener. *Metals Technology,* v. 11, Dec. '44, pp. 44-58.

Flow stress and fracture strength obtained over a wide range of temperature and of strain rate for both pearlitic and a tempered martensitic steel at two stress levels. Effect of deformation upon fracture strength obtained for a pearlitic steel. Observations indicate that deformation has a negligible effect upon the fracture strength of the tempered martensitic steel. In the yield-strength ranges of the steels examined, only the pearlitic steels were brittle at high strain rates and at low temperatures. 7 ref.

3-11. **Some Speculations Regarding the Plastic Flow and Rupture of Metals Under Complex Stresses.** L. R. Jackson. *Metals Technology,* v. 11, Dec. '44, pp. 59-79.

Capacity of a metal for plastic flow before rupture is dependent on the type of stress system applied. Means of representing the effect of complex stresses on plastic flow. Methods of obtaining complex stress distribution. Experimental results showing the effect of types of complex stress on the capacity of various metals for flow. 9 ref.

3-12. **Deformation of Metals.** H. W. Swift. *Metallurgia,* v. 31, Dec. '44, pp. 53-62.

An engineer's assessment of the problems involved in the mechanics of stress and strain, and of the contributions which can be made to it by the application of mechanical principles.

3-13. **Bearing Strength in Airplane Design.** Albert Epstein. *Journal of the Aeronautical Sciences,* v. 12, Jan. '45, pp. 67-84.

Bearing stress criteria for aluminum alloys, if applied to heat treated steel, would permit allowable stresses as much as 50% greater than those used at present for steel. Allowable strength values for some single-rivet joints may be

almost as high as the acting failing strength. In several applications, described, it is desirable to use some factor or margin of safety with these values because of discrepancies between computed and actual rivet loads. 18 ref.

3-14. **Some Thoughts on Medium and High Tensile Wrought Alloy Steels, Present and Future.** J. H. G. Monypenny. *Metallurgia,* v. 31, Dec. '44, pp. 79-82.

Consideration given to the types of low alloy steels developed in the last few years and to the need for eliminating restrictions from specifications for alloy steels in the postwar years.

3-15. **Copper and Copper Alloys.** H. J. Miller. *Metallurgia,* v. 31, Dec. '44, pp. 83-87.

The industry is not only concerned with increased production, but is persistent in its efforts to improve the quality of products; incorporates the more outstanding contributions to progress during the present year.

3-16. **Progress in Research Methods in the Metallurgy of Cast Iron with Special Reference to Gases in Cast Iron.** J. E. Hurst. *Metallurgia,* v. 31, Dec. '44, pp. 92-97.

Progress in research methods in relation to a recurring problem experienced in the iron foundry; composition, constitution and properties of cast iron.

3-17. **Silicon Bronzes.** *Machine Design,* v. 17, Jan. '45, pp. 163-167.

Analyses, properties, characteristics, applications, fabrication, resistance to corrosion, annealing, material designations, trade names.

3-18. **The Influence of Arsenic and Bismuth on the Mechanical Properties of Copper-Nickel-Phosphorus Alloys.** Clement Blazey. *Australasian Institute of Mining & Metallurgy,* no. 135, Sept. 30, '44, pp. 65-81.

Precipitation-hardening properties of the copper-nickel-phosphorus alloys, and influence of arsenic and bismuth, singly and together, on the mechanical properties of these alloys. 3 ref.

3-19. **Influence of Nitrogen on the Properties of Certain Austenitic Valve Steels.** *V.D.I. Zeitschrift,* v. 88, March 4, '44, p. 133.

The alleged favorable influence of nitrogen additions to highly heat resistant chromium-nickel alloy steels could not be confirmed. Further investigations are being performed.

3-20. **How Much Ductility Is Necessary for a Structure or Machine?** W. J. Conley. *Welding Journal,* v. 24, Jan. '45, pp. 51-56.

Interesting discussion of ductility and comments on its significance in welded structures. 29 ref.

3-21. **Stresses in Welded Structures.** H. C. Boardman. *Welding Journal,* v. 24, Jan. '45, pp. 57s-60s.

Fusion welded structures of plain low carbon steels having well-defined plastic yield ranges at about one-half of the ultimate strength. These ranges are for uniaxial (one-directional) stresses.

3-22. **Chart of Comparable Tool Steels.** *Iron Age,* v. 155, Feb. 1, '45, pp. 44-47.

Table answers many questions regarding the selection of tool steels; trade names and manufacturers of the nine main classifications of tool steels, and auxiliary tables summarize the application, approximate heat treatment, and chemical composition of each type not strictly within the type analyses.

3-23. **Recovery of Cold-Worked Aluminum Iron as Detected by Changes in Magnetic Properties.** J. K. Stanley. *Metals Technology,* v. 12, Jan. '45, T. P. 1767, 10 pp.

Shows the feasibility of using magnetic methods in detecting internal strains; how such properties as permeability, remanence, and coercive force change on cold working of aluminum iron and how these magnetic properties change during the annealing below the recrystallization temperatures. Work conducted to see how strains are relieved at low temperatures.

3-24. **Porosity in Copper Alloy Castings.** K. Strauss. *Canadian Metals and Metallurgical Industries,* v. 8, Jan. '45, pp. 27-28.

Causes and prevention in materials with high copper content. Article deals with gas porosity only as encountered in alloys of high copper content, such as tin bronzes, phosphor bronzes and gun metals.

3-25. **A Study of Work-Hardening and Reannealing of Iron.** M. Balicki. Iron and Steel Institute Advance Copy, Dec. '44, 43 pp.

Changes in various properties of Armco iron wires resulting from 12 different degrees of work hardening, and subsequent annealing in a vacuum. On the same samples, or on exactly similar material, the following properties were determined: Hardness, electrical resistivity, elastic limit from the bend test, plastic limit, ultimate stress, uniform elongation, springiness, thermo-electric properties and microstructure. Attention was paid to the effect of the time of annealing and to the order of the inaccuracy caused by aging. Some other effects of which account should be taken are also indicated. A survey of the changes induced by reannealing confirms the presence of three phenomena—strain aging, recrystallization and crystal growth. 70 ref.

3-26. **Lithium.** Electrochemical Society Bulletin, Jan. '45, p. 2.

Properties and uses.

3-27. **Ferrous Physical Metallurgy.** Francis M. Walters, Jr. *Mining and Metallurgy,* v. 26, Feb. '45, pp. 87-89.

Progress reported in studies of hardenability, graphitization, embrittlement, and dilatometry.

3-28. **Creep of Metals.** James L. Erickson. *Light Metal Age,* v. 3, Jan. '45, pp. 22-23, 26-27.

Introduces the light metal technician to creep; there is a large demand from the aircraft industry for high strength, weight saving metals and metal products which have the ability to retain their strength at temperatures above normal, and which remain unaffected by large temperature variations.

3-29. **Some Recent Developments in Engineering Materials.** Archibald Black. *Mechanical Engineering,* v. 67, Feb. '45, pp. 101-108.

National Emergency steels; low cost alloy steels; isothermal transformation of steel; interrupted quenches; cold treatment of steel; steel hardenability calculated from composition; high strength cast irons and cast steels; leaded steels; graphitic steels; boron steel; nitrogen as an alloying element in steels; nitride case hardening of stainless steels; silicon impregnation of steel; new magnetic alloys; Ni-Fe-Ti alloys. 98 ref.

3-30. **Some Engineering Properties of Nickel and High-Nickel Alloys.** B. B. Betty and W. A. Mudge. *Mechanical Engineering,* v. 67, Feb. '45, pp. 123-129.

Summarizes the principal properties of approximately a score of important wrought and cast nickel materials which contain more than 50% of nickel and which have been used extensively for power equipment, petroleum, laundry, food service, household equipment, pickling, roofing, and paper and pulp industries because of their excellent strength and corrosion resisting characteristics. Some economical methods for construction of special equipment.

3-31. **Nickel-Bronze Castings.** E. Portman. *Metal Industry,* v. 66, Jan. 12, '45, p. 26.

Describes the changes found necessary with the alloy which had previously given satisfactory results to one with a lower tin content, to obtain equally good results. (Condensed from *Metals and Alloys.*)

3-32. **Magnesium Alloys and Their Application.** D. A. Tooley. *Machinery,* v. 51, Feb. '45, pp. 146-151.

Characteristics and properties of the various compositions available commercially, and factors to be considered in the fabrication of parts from these alloys.

3-33. **Effect of Boron on Machinability and Hardenability.** T. G. Harvey. *Iron Age,* v. 155, Feb. 15, '45, pp. 52-54.

Tests on the influence of boron in a medium carbon resulphurized open-hearth steel indicate an increase in hardenability of 31%, and, as anticipated, an impairment of 5% or more in machinability.

3-34. **New Titanium Steel for Vitreous Enameling.** G. F. Comstock and E. Wainer. *Iron Age,* v. 155, Feb. 15, '45, pp. 60-63, 152-153.

By converting carbon in steel to a more stable form with heavy additions of titanium it does not react with oxides in enamel coatings to form gas and blisters. With certain precautions one-coat one-fire finishes are practicable.

3-35. **Striking Improvements in Machinability Claimed for Leaded Steels** *Steel,* v. 116, Feb. 19, '45, pp. 136-139.

Machinability constants of leaded steel said to be 24 to 35% higher than non-leaded types with increases in feed from 36 to 60%. Phenomenal gains in tool life also held possible by this technique.

3-36. **Stainless Steels, AISI Types 430 and 430F (Materials Work Sheet).** *Machine Design,* v. 17, Feb. '45, pp. 175-178.

Properties; physical constants; characteristics; applications; fabrication; resistance to corrosion; galvanic corrosion; annealing; data on stock forms; material trade names.

3-37. **Relationship Between Hardenability and Percentage of Martensite in Some Low Alloy Steels.** J. M. Hodge and M. H. Orehoski. *Tool & Die Journal,* v. 10, Feb. '45, pp. 139-140.

Evaluates the relationship between hardenability on the 50% martensite basis and that based on higher percentages of martensite in low alloy steels. (Condensation of a paper presented before the annual meeting of the American Institute of Mining and Metallurgical Engineers, New York City, Feb. 19-22, 1945.)

3-38. **Graphitization of Low-Carbon and Low-Carbon-Molybdenum Steels.** H. J. Kerr and F. Eberle. *Welding Journal,* v. 24, Feb. '45, pp. 86s-122s.

Some typical conditions which illustrate pertinent facts with respect to the laboratory experiments, the testing procedure described and the results obtained. Summary of the conclusions at which the authors arrived presented.

3-39. **An Exploration of the Problem of Superheating in Magnesium-Base Alloys.** F. A. Fox and E. Lardner. Institute of Metals *Journal,* v. 71, Jan. '45, pp. 1-22.

Grain-refining effect is confined to alloys containing aluminum, and tendencies to grain coarsening are introduced if the superheating time is too long or the temperature too high. Data are given relating tensile properties to grain size in various aluminum-containing alloys. Microstructures of super-heated alloys differ characteristically from those of the unsuper-heated material, and this difference persists even after a solution treatment, the unsuperheated alloy giving a mixed grain size. Grain sizes are recorded for an alloy, superheated and unsuperheated, cast as rods of various cross-sections. Stirring just before casting does not eliminate the grain-refinement effect of the superheating. 6 ref.

3-40. **Some Effects of Oxygen in Silver and Silver Alloys.** J. C. Chaston. Institute of Metals *Journal,* v. 71, Jan. '45, pp. 23-35.

Oxygen-free silver containing 0.01 to 0.02% of metallic impurities is annealed in air; a zone of fine grains is formed directly beneath the surface, while in the interior of the metal recrystallization and grain growth proceed normally. No such zone is formed when this metal is annealed in vacuum or in hydrogen. When oxygen-bearing silver containing these traces of impurities is heated in hydrogen, however, the metal is embrittled by a reaction similar to that produced by hydrogen annealing tough pitch copper. The mechanism of these reactions has been followed by heating strips of silver exposed on the one side to oxygen and

on the other to hydrogen. Neither grain-growth restraint nor hydrogen embrittlement is observed in very pure silver, and it is suggested that the effects in the less pure metal may be due to distributed particles of metallic oxides formed by internal oxidation. Alloys of silver with small amounts of aluminum or zinc are hardened for a small distance below the surface when annealed in air, apparently as a result of a similar mechanism. A "reversed precipitation" effect can also be produced if silver containing oxygen in solution is heated in the vapor of zinc, which presumably diffuses into the silver and combines with the oxygen in solution to form dispersed particles of zinc oxide which cause hardening. 8 ref.

3-41. **The Making of High-Duty Iron Castings to Specification.** E. Hunter. *Foundry Trade Journal,* v. 75, Feb. 1, '45, pp. 95-97.

Development of iron founding demands new properties in cast iron.

3-42. **The Gassing and Degassing of Metals and Alloys.** J. C. Chaston. *Metal Treatment,* v. 11, Winter '44-'45, pp. 213-218, 212.

Discusses the terms "gassing" and "degassing" as used by different technicians, notably in the foundry and by electronic engineers. Methods of degassing molten metals and the uses of gas-free metals. 13 ref.

3-43. **New Corrosion-Resistant Precipitation-Hardening Alloy.** *Industrial Heating,* v. 12, Feb. '45, pp. 302, 304.

New precipitation-hardening alloy claimed to possess exceptional uniformity in response to heat treatment has a nominal chemical composition of 60% copper, 20% nickel, and 20% manganese, and is designated as No. 720 Manganese Alloy. It is corrosion resistant, not differing greatly from the cupronickels.

3-44. **Segregation in Babbitt.** T. E. Eagan and W. R. McCrackin. *Metal Industry,* v. 66, Feb. 16, '45, pp. 103-105.

Casting procedures for white-metal bearings vary according to the caprice or facilities available at the plant. Tested with regard to their effect on unsoundness and found that segregation can be avoided by careful control. (Paper given to A. I. M. E.)

3-45. **Graphitization of Low-Carbon and Low-Carbon-Molybdenum Steel.** H. J. Kerr and F. Eberle. *Steel,* v. 116, March 19, '45, pp. 118, 120, 160, 162, 164.

Controlled graphitization tests develop much information on the service behavior of materials used in elevated temperature applications. Molybdenum additions to a steel found to exert a very definite resistance to graphitization of that steel. McQuaid-Ehn test described as valuable criterion of the graphitizing tendency of carbon and carbon-molybdenum steels in this A.S.M.E. report.

3-46. **Grain Size and Properties of Sand-Cast Magnesium Alloys.** R. S. Busk and C. W. Phillips. *Metals Technology,* v. 12, Feb. '45, T. P. 1771, 11 pp.

Data giving the relationship between grain size and mechanical properties. Data also included on the combined effects of grain size and microporosity. In addition, a short discussion of factors influencing the grain size of sand castings is included. 9 ref.

3-47. **Modern Cast Iron.** A. J. Milgate. Australian Institute of Metals: *Australasian Engineer,* v. 44, Sept. 7, '44, pp. 29-35. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 74-A.

A brief story of the development of cast iron is followed by an account of some aspects of the manufacture of high duty cast irons of tensile strengths of the order of 25 tons per sq. in. Factors in cupola operation and inoculation processes are dealt with, and some of the practical difficulties associated with the production of high duty cast iron reviewed. Notes on heat treatment and flame hardening are included, and the more important physical properties are listed.

3-48. **Thermodynamic Properties of Carbides of Chromium.** K. K. Kelley, F. S. Boericke, G. E. Moore, E. H. Huffman and W. M. Bangert. United States Bureau of Mines. Technical paper no. 6627, 1944. Iron and Steel Institute *Bulletin,* no 109, Jan. '45, p. 87-A.

The preparation of the carbides of chromium is described, and the results of low and high temperature specific heat measurements are given; the data are correlated satisfactorily, and thermodynamic values and functions for the carbides are derived.

3-49. **Why Use Rustless Stainless Steel?** *Iron Age,* v. 155, March 22, '45, pp. 97-99.

How to select the proper stainless grade; how stainless is fabricated; comparison of stainless properties; electropolishing stainless steels.

3-50. **Cast Iron Metallurgy.** J. E. Hurst. *Iron & Steel,* v. 18, Jan. '45, pp. 14-17.

Developments in research methods and apparatus.

3-51. **Graphitization of Welded and of End-Quenched Carbon and Molybdenum Steels.** G. V. Smith and S. H. Brambir. *Welding Journal,* v. 24, March '45, pp. 153s-157s.

End-quenched specimens and welded samples of a series of carbon steels ranging from 0.15 to 0.80% carbon, and of low-carbon 0.5% molybdenum steels, some of which had been heat treated 4 hr. at 1300° F. immediately after welding with the aim of preventing graphitization, were examined for graphite after 1000, 2000 and 3000 hr. at 975 to 1050° F. 5 ref.

3-52. **Definitions of Tensile Properties.** *Industry & Welding,* v. 18, March '45, pp. 82-85.

When a metal part is overloaded, it suddenly stretches rapidly at a point called the yield point. Then it is permanently deformed, unbroken but bent out of shape. In actual service, the yield strength of a material is usually much more important than its breaking strength.

3-53. **Some Recent Developments in Engineering Materials.** Archibald Black. *Mechanical Engineering,* v. 67, March '45, pp. 190-198.

"Vanasil," a low-expansion aluminum alloy; aluminum-steel bonding; aluminum plating; refrigeration of heat treated aluminum alloys; porous chromium surfacing; die casting materials and practices; tin and lead coatings on steel; tinless solders; silver bearing and other babbitts; copper brazing methods; laminated metals; high nickel alloys; lost wax casting of metals; calcium; lithium. 112 ref.

3-54. **Electrolytic Manganese—II.** *Metal Industry,* v. 66, March 2, '45, pp. 136-137.

Allotropes; high manganese alloys; effect of impurities; heat treatment. 5 ref.

3-55. **Cast Iron Metallurgy.** J. E. Hurst. *Iron and Steel,* v. 18, Feb. '45, pp. 53-54.

Developments in research methods and apparatus.

3-56. **Properties of Thorium-Bearing Heat-Treatable Steels.** *Iron Age,* v. 155, March 29, '45, p. 55.

Effect of additions of thorium to three steels alloyed with vanadium, chromium and molybdenum.

3-57. **Nitrogen in Chrome-Nickel Steels.** *Iron Age,* v. 155, March 29, '45, pp. 56-60.

Improvements in mechanical and electrical properties resulting from a partial substitution of nitrogen for nickel in austenitic and austenitic-ferritic chromium-nickel steels. Translation by C. M. Cosman of an article in *Stahl und Eisen.*

3-58. **Boron in Malleable Iron.**. Norman F. Tisdale. *Foundry,* v. 73, April '45, pp. 107, 222.

Extensive study of the subject has shown that boron, when properly used, results in a reduction in the annealing time, and also lessens the need of re-annealing.

3-59. **Development and Properties of Sand Cast Aluminum Alloy Having High Strength After Aging Without Previous Heat Treatment.** Hiram Brown. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1037-1051.

Development and properties of a sand cast aluminum-base alloy containing magnesium, zinc, and small amounts of titanium and chromium called B-81. 9 ref.

3-60. **The Effect of Copper on the Properties of Cast Carbon-Molybdenum Steels.** N. A. Ziegler and W. L. Meinhart. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1151-1174.

Results of studies of the effects of copper on the physical properties of carbon-molybdenum cast steels. Data obtained from the studies are shown in graphic and tabular form. 79 ref.

3-61. **Hardenability and the Steel Casting.** K. L. Clark and J. H. Richards. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1325-1346.

Cast and forged steels of identical compositions, in the low and medium alloy range, have comparable

hardenability when variations in grain size are considered. Increasing the normalizing temperature of the cast steels from 1700° F. (925° C.) to 2000° F. (1090° C.) prior to quenching from 1650° F. (900° C.) has little effect on the hardenability except as it alters the austenitic grain size. In steels with appreciable amounts of chromium or molybdenum, the carbide forming elements covered in this study, a quenching temperature of 1650° F. (900° C.) is not high enough to insure complete solution of all of the carbides and the measured hardenability is lower than that calculated from composition and grain size. 14 ref.

3-62. **Platinum and Its Production.** *Metallurgia,* v. 31, Feb. '45, pp. 173-175.

Deals with some historical aspects, production of the metal, and some of its properties and uses.

3-63. **100 Years of Aluminum.** Freeman Horn. *Metallurgia,* v. 31, Feb. '45, pp. 176, 177-179.

Laboratory, commercial and industrial periods, and the part played by Britain in the progress of this metal and its alloys.

3-64. **Aluminum Alloy Sheet and Strip.** E. G. West. *Metallurgia,* v. 31, Feb. '45, pp. 193-196.

Surveys these products and directs special attention to the remarkable progress so far achieved.

3-65. **Modern High-Duty Cast Iron.** E. W. Harding. *Machinery* (London), v. 66, March 8, '45, pp. 255-258.

Brief account of the mechanical properties of modern high-duty iron indicates the extent of the advance made in recent years in cast iron development. Emphasis given to the significance of the properties from an engineering point of view. Mention made of the special properties of the material which are already recognized; i.e., easy machinability, density, and solidity in varying casting sections, exceptional wear resistance, good response to heat treatment for hardness and strength, and fluidity which permits easy casting into intricate shapes.

3-66. **Magnesium and Its Alloys.** M. Loretan. *Schweizer Archiv,* v. 9, no. 7, July '43, pp. 219-228; Discussion *Schweizer Archiv,* v. 9, no. 8, August '43, pp. 258-259. British Non-Ferrous Metals Research Association *Bulletin,* v. 25, Feb. '45, p. 36.

Outlines production of magnesium by thermal and electrolytic methods giving flow sheets; reference to manufacture in Switzerland; properties of magnesium; effect of alloying elements and characterization of the more representative types of alloys (tables of compositions and properties).

3-67. **Process Control in Modern High-Duty Cast Iron.** E. W. Harding. *Machinery* (London), v. 66, March 15, '45, pp. 285-288.

Shows how the reliability of this metal has been ensured by manufacturing methods which provide a uniform product.

3-68. **Heat Resisting Alloys.** *Automobile Engineer,* v. 35, March '45, p. 98.

For heavy tensile loads at high temperatures.

3-69. **Mechanical Properties and Weldability of High Strength Plate.** George F. Comstock. *Metal Progress,* v. 47, March '45, pp. 511-520.

Investigation of high strength plate steel extended to include commercial plates of similar analyses, made under the conditions of actual steel mill practice to determine whether the preliminary conclusions would apply to tonnage production. The excellent properties and weldability of manganese-titanium steel are confirmed by tests on commercial plates from several sources.

3-70. **Metallurgy of Foreign Materiel.** J. H. Frye. *Automotive Industries,* v. 92, April 1, '45, pp. 33, 90, 92, 94, 98.

Foreign Materiel Branch established at Aberdeen Proving Ground to receive, catalog, proof test and arrange captured enemy material for engineering study and analysis. Some findings reported.

3-71. **The Past and Future of Steel.** C. H. Desch. *British Steelmaker,* v. 11, March '45, pp. 102-109.

Chemical analysis; microscopy; Thomas process; corrosion; alloy scrap recovery; low alloy steel; raw materials; post-war demand; scientific control required; training personnel; classes in working hours.

3-72. **True Stress-True Strain Diagrams, II.** *Metal Industry,* v. 66, March 30, '45, p. 197.

Search for fundamental relationships. 3 ref.

3-73. **Beryllium Copper.** E. R. Yarham. *Iron Age,* v. 155, April 26, '45, pp. 63-67.

To the extensive amount of general data which has been published in recent years is added this contribution from British sources, presenting much specific data on mechanical and physical properties of an alloy which has considerable post-war application possibilities.

3-74. **The Shape of a Material's Reactions to Force, I.** A. C. Vivian. *Metallurgia,* v. 31, March '45, pp. 225-229.

Conceptions of properties; tensile compression and shear tests; loading differences; measuring strain; hardness, toughness, and fatigue endurance; special tests for materials; one true curve; features of the true curve.

3-75. **Beryllium Copper.** *Metallurgia,* v. 31, March '45, pp. 247-248.

Characteristics and properties of a beryllium-copper alloy, Cu.B.250.

3-76. **Stainless Steels—Basic Types.** *Metals & Alloys,* v. 21, April '45, pp. 1033, 1035.

Martensitic and ferritic. AISI type; composition; hardening temperature; properties and uses.

3-77. **The Rare Metals Go to Work and to War.** H. A. Bolz. *Modern Machine Shop,* v. 17, May '45, pp. 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154.

Familiarity with known properties and characteristics

of less common elements by all engineers and production men will lead to quicker and more effective utilization of these properties for the betterment of war equipment and post-war products.

3-78. **Comparative Properties of Cast and Forged Steel.** C. E. Sims. *Foundry,* v. 73, May '45, pp. 90-93, 192, 195.

Compares the properties of forged and centrifugally cast aircraft engine cylinder barrels, especially in fatigue. Centrifugally cast barrels from two heats of steel and forged barrels from one heat of steel were procured in the rough machined condition. Compositions of the three heats given.

3-79. **Copper and Copper-Base Alloys.** J. W. Donaldson. *Metal Industry,* v. 66, April 20, '45, pp. 242-244.

Review of American investigations and researches during 1944. 13 ref.

3-80. **Temper Brittleness and Heat Embrittlement of Alloy Steels.** P. B. Michailow-Michejew. *Archiv für däs Eisenhüttenwesen,* v. 17, Jan.-Feb., '44, pp. 177-180. *Bulletin* Iron & Steel Institute, no. 111, March '45, p. 137-A.

An investigation is reported on the influence of the hardening and tempering temperatures, the tempering time, the cooling rate after tempering, a prolonged second tempering, cold deformation and the chemical composition on the temper brittleness and heat embrittlement of low alloy steels. The brittleness was determined by notched-bar impact tests at room temperature as well as between —200° and +500° C. The specimens were cut from chromium-nickel and chromium-nickel-molybdenum steels. Temper brittleness and heat embrittlement are phenomena of similar nature and can be regarded as related to the embrittlement which occurs at low temperatures. This brittleness results from the steel remaining for a considerable time in a critical temperature range the extent of which depends upon the tempering time and the chemical composition; the phenomenon often occurs at between 400 and 550° C. It can be prevented by alloying the steel with elements which impede the shifting of the brittle range to higher temperatures. An addition of molybdenum to chromium-nickel steels acts in this way. The susceptibility of chromium-nickel steels to heat embrittlement can be reduced by holding them at a high temperature (up to 650° C.) for at least 24 hr., provided that this treatment does not raise the cold-embrittlement temperature range to room temperature.

3-81. **On the Kinetics of the Formation of Oxide Films on the Surface of Metals.** J. Frenkel. Academy of Sciences of U.S.S.R., *Journal of Physics,* v. 8, no. 4, '44, pp. 225-229. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 141-A.

A mathematical study of the dissociation of adsorbed oxygen molecules into atoms and the rate of penetration of the atoms into the surface of metals is presented.

3-82. **Previewing the Future for Low Alloy, High Strength Steels.** F. D. Foote. *Steel,* v. 116, April 25, '45, pp. 102-104.

Careful re-examination of equipment, machinery and structures is in order where there is the possibility of redesigning for higher efficiency and longer service life to be found in improved low-alloy steels.

3-83. **Lowering of the Photoelectric Work Function of Zirconium, Titanium, Thorium and Similar Metals by Dissolved Gases.** H. C. Rentschler and D. E. Henry. Electrochemical Society. Preprint 87-14, April 16, '45, 10 pp.

It is well known that the photoelectric threshold of certain metals such as caesium, barium, thorium, etc., is shifted toward the longer wave length when the metal reacts with oxygen. Describes experiments which show a photoelectric threshold shift due to the interaction of oxygen, nitrogen or hydrogen with zirconium, titanium, etc. The results indicate that the lowering of the photoelectric work function is caused by the formation of a solid solution of the gas in the metal.

3-84. **Metal Lusters: Their Characteristics and Limitations in Vacuum Tube Applications.** S. F. Essig. Electrochemical Society. Preprint 87-16, April 16, '45, 12 pp.

Physical and chemical characteristics of certain typical lusters, under conditions applying in special vacuum tube applications, are discussed. For most applications, flux-free lusters are not suitable, primarily because of the poor adherence of the final film. The commercially available flux-bearing variety may be the source of contamination due to the presence of volatile inorganic compounds. Also, because of the composite character of these films, they may not be stable under conditions common in vacuum tube practice.

3-85. **The A-B-C of Corrosion and Heat Resisting Steels.** *Metal Progress,* v. 47, May '45, p. 936-B.

Chart showing types; analysis; heat treatment; toughness; structural changes at high temperatures; strength at elevated temperatures; working qualities; machinability; riveting; welding properties; corrosion resistance; scaling resistance.

3-86. **Aluminum Bronzes (Materials Work Sheet).** *Machine Design,* v. 17, May '45, pp. 145-149.

Analyses; properties; characteristics; applications; fabrication; heat treatment; annealing and pickling; resistance to corrosion; galvanic corrosion.

3-87. **Copper and Copper-Base Alloys.** J. W. Donaldson. *Metal Industry,* v. 66, April 27, '45, pp. 258-260.

Effect of various elements on the mechanical properties and dezincification of manganese bronze, and summarizes various researches on corrosion. Continuous and centrifugal casting mentioned. 13 ref.

3-88. **Beryllium—the Light Metal.** Z. J. Atlee. *Modern Metals,* v. 1, April '45, pp. 7-8.

Beryllium used for new applications in increasing amounts since entry into the war. General outline of the metal, its properties and alloys. 5 ref.

3-89. **High Strength Cast Irons.** *Metals and Alloys,* v. 21, May '45, pp. 1355, 1357.

Compositions of typical high strength cast irons; physical properties of some of the high strength cast irons.

3-90. **Alloying Magnesium.** G. Eldridge Stedman. *Steel,* v. 116, May 21, '45, pp. 130, 133, 164, 166, 168, 170.

Great strength, durability and ductility are imparted by addition of zinc, aluminum and manganese. Flux introduced on surface of metal during meltdown prevents burning. Special gates and risers are required.

3-91. **Combatting Microshrinkage in Casting Magnesium.** Robert Van Brunt. *Aluminum & Magnesium,* v. 1, May '45, pp. 28-29, 34.

New Mg-Mn-Al-Zn alloy with lower susceptibility to microshrinkage, and better flowability and casting characteristics.

3-92. **Creep Strength of Zinc and Zinc Alloy Sheets.** *Zeitschrift für Metallkunde,* v. 26, Feb. '44, pp. 43-45.

3-93. **The Effect of Ferrous Metal Additions on the Properties of Zinc.** Franz Pawlek. *Zeitschrift für Metallkunde,* v. 36, May '44, pp. 105-111.

3-94. **Permeability Measurements on 0.1 to 0.01-Cm. Thick Ni-Fe Strip.** Gunther Rassman. *Zeitschrift fur Metallkunde,* v. 36, June '44, pp. 131-135.

3-95. **Formation of Oxide Layers on Different Nickel Alloys.** Lore Horn. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 142-145.

3-96. **Influence of Small Additions of Thorium on the Life of Heat-Conducting Alloys.** Werner Hessenbruch and Lore Horn. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 145-146.

3-97. **Cast and Forged Steels Compared.** C. E. Sims. *Steel,* v. 116, June 4, '45, pp. 113-114, 116, 152, 154.

After making comparative study of physical properties of the two materials, Battelle Memorial Institute researchers conclude there is little to choose between forged and soundly cast steel parts. Limited forging of cast blanks sometimes effective.

3-98. **Recent Developments in Copper-Base Alloys.** Arthur L. Clark. *Iron Age,* v. 155, June 7, '45, pp. 64-68.

Advances in metallurgy, melting practice and rolling have resulted in superior bronzes of the aluminum, silicon and phosphor types. Particularly where high strength, resistance to fatigue and corrosion resistance are factors, the advantages of these copper-base alloys outweigh their higher cost and make dependability in a given application the governing factor.

3-99. **Progress Report on Graphitization of Steam Lines.** S. L. Hoyt and R. D. Williams. *Welding Journal,* v. 24, May '45, pp. 274s-282s.

Weld prober samples were removed at and adjacent to the welded joints and examined for graphite and tested for ductility. With data on materials, welding conditions and service history, work has contributed substantially to the basic understanding of the problem and has been of great assistance to the research work which is being done. 8 ref.

3-100. **A Note on the Physical Properties of an Austenitic Weld Metal and Its Structural Transformation on Straining.** K. Winterton. *Welding Journal,* v. 24, May '45, pp. 308s-310s.

Mechanical tests at elevated temperatures on composite 18-8 weld-plate tensile specimens, showed that the tensile strength, yield strength, and hardness declined with increased testing temperatures. Effect of prior heat treatment at 850° C. in causing increased tensile strength, and decreased yield strength, decreased with testing temperature and was not apparent above 150° C. Microscopic examination showed a breakdown of dendritic regions to a light-etching α-constituent, and the formation of lines and blocks of a deep-etching α-constituent, probably due to uneven straining. 3 ref.

3-101. **Tantalum: Past History and Present Uses.** M. Schofield. *Industrial Chemist,* v. 21, April '45, pp. 207-209.

Battery charger; extraction; properties; applications. 6 ref.

3-102. **Segregation in Babbitt.** American Society of Naval Engineers *Journal,* v. 57, May '45, pp. 241-248.

Segregation in babbitt, and its effect on the final cast structure. Each composition exhibits certain specific types of segregation and two compositions of babbitt are presented — a tin base and a lead base. Bearings usually are cast either statically or centrifugally; therefore the effect of these two methods on segregation is presented.

3-103. **Distribution of Mechanical Properties in Sand Cast Bronzes.** R. H. Brouk, R. G. Hardy, and B. M. Loring. *American Foundryman,* v. 7, June '45, pp. 61-66.

Effect of composition on the variations in mechanical properties in a heavy bronze casting. Corresponding locations studied with respect to microstructure, grain size, specific gravity, chemical composition and mechanical properties. 5 ref.

3-104. **Die and Hobbing Steels for Plastics Molds.** Ray P. Kells. *Modern Plastics,* v. 22, June '45, pp. 130-133.

Requirements of a mold or die material are: It must be clean and free from porosity; it must not deform in hardening; it must harden to a relatively high hardness and to a depth sufficient to resist sinking under high pressures; it must in many cases be able to resist the abrasive action of plastics; when corrosive plastics are used, the die material must resist this action; must meet all requirements insofar as fabrication of the mold is concerned.

3-105. Characteristics of the Ag-Cs and Sb-Cs Photoelectric Surfaces. G. Lewin. Electrochemical Society preprint 87-22, 8 pp.

Characteristics of the S1 (Ag-Cs) and S4 (Sb-Cs) photoelectric surfaces are discussed. Procedures followed in producing these surfaces are outlined. Data on current output, spectral sensitivity, dark current, and fatigue are given. Theoretical considerations of the probable electrochemical action responsible for sensitivity of the S1 surface in the red region are presented.

3-106. Molybdenum. W. H. Dennis. *Mine & Quarry Engineering,* v. 10, May '45, pp. 119-123.

Production and uses.

3-107. Intercrystalline Cracking of Lead. *Metal Industry,* v. 66, June 1, '45, pp. 345, 348.

Example of a metallurgical "hard case." 7 ref.

3-108. Standard Malleable Irons—Work Sheet. *Machine Design,* v. 17, June '45, pp. 149-152.

Characteristics; applications; fabrication; reaming; tapping; milling; localized hardening; resistance to corrosion; protective coatings; design tips.

3-109. New Uses for Aluminum Alloys. *Western Miner,* v. 18, June '45, pp. 78, 80, 82.

Development of new alloys; machinability of the aluminum alloys can be increased by the addition of lead and bismuth; small amounts of magnesium added to aluminum alloys increase the corrosion resistance and physical properties of the metal; importance of electro-chemistry in the aluminum industry; new aluminum tin bearing alloy with outstanding properties.

3-110. Graphitization of Steel. H. J. Kerr and F. Eberle. *Iron and Steel,* v. 18, May '45, pp. 164-168.

Investigations on low carbon and low carbon molybdenum types. (Presented at a meeting of the American Society of Mechanical Engineers).

3-111. Effect of Boron on Aluminum Castings. *Iron Age,* v. 155, June 21, '45, p. 61.

Determines the effects of boron trichloride on an aluminum permanent mold casting alloy. This modifier used in alloy 356, which contains 7% silicon and 0.3% magnesium, serves to refine the grain structure and modify the microporosity from the sharp shrink type to the rounded gas type of cavity, reduces mechanical properties of castings, increases brittleness but does not affect corrosion resistance or heat treatment characteristics of the alloy.

3-112. Discussion—Graphitization of Low-Carbon and Low-Carbon-Molybdenum Steels. *Welding Journal,* v. 24, June '45, pp. 350s-359s.

Investigation of graphitization of the high-temperature piping in the Public Service Electric and Gas Co. Stations.

3-113. The Anodic Behaviour of Metals, I.—Platinum. A. Hickling. *Transactions of the Faraday Society,* v. 41, June '45, pp. 333-339.

Initial build-up of anodic polarization at a smooth platinum anode over a wide range of conditions investigated by a new oscillographic method. Three main stages in the polarization have been distinguished corresponding to the ionization of hydrogen, the charging of a double layer, and the deposition of oxygen at the electrode.

3-114. **Role of Molybdenum and Associated Alloys in Cast Iron.** Joseph C. Kinsella. *Canadian Metals & Metallurgical Industries,* v. 8, June '45, pp. 35-37.

Attempts to build up an understanding of the actual function of a few of the commonly used alloying elements, and how they alter the properties of ordinary cast iron so profoundly. Effect of copper, chromium, molybdenum, vanadium.

3-115. **A White High-Manganese Brass.** R. S. Dean, J. R. Long, T. R. Graham, and C. W. Matthews. *Metals Technology,* v. 12, June '45, T.P. 1813, 9 pp.

Study of an alloy having the composition of 70% copper, 20% manganese, and 10% zinc. This alloy remained single-phase throughout the working and annealing cycles of the preliminary tests and appeared to be about the strongest of the white single-phase alloys. The project included an investigation of additional alloys, deviating from this composition by 5% of each of the three components to evaluate the effects of variation in composition; also a study of the properties of the central alloy made with silicothermic manganese.

3-116. **Austenitic Weld-Metal.** K. Winterton. *Welding,* v. 13, June '45, pp. 206-209.

Physical properties of an austenitic weld-metal and its structural transformation on straining. 3 ref.

3-117. **The Possibilities of Light Alloys in Industry.** A. Russell. *Machinery* (London), v. 66, May 24, '45, pp. 565-567.

Wrought aluminum alloys are available in three types: Alloys that need no heat treatment to give the maximum strength; alloys of the type which need solution treatment, i.e., heating to about 500° C. for a given time and quenching in water; alloys which need both solution and precipitation treatments before reaching their maximum strength.

3-118. **Indium.** William S. Murray. *Modern Metals,* v. 1, July '45, pp. 6-9.

Broad outline on indium presented as a result of numerous requests relative to specific data about this metal. In addition, plating light metals with indium for surface protection, hardening and decorative finishes, is a future possibility and may be worth investigating.

3-119. **The Strength Characteristics of Alclad Sheet.** I. G. Bowen. *Sheet Metal Industries,* v. 21, June '45, pp. 992-994, 1000.

Devoted to the characteristics of the commonly used light alloy Alclad sheet to specification DTD 390 and two aspects of the material are discussed. Correlation

between proof stress and ultimate stress is examined. Secondly, similar examination of elongation and ultimate stress is made. Material used to provide the data was drawn at random from the stocks of various manufacturers and the thicknesses of the sheets varied from 10 to 24 s.w.g.

3-120. **Metals for Service at Sub-Zero Temperatures.** Paul Beal Petty. *Chemical & Metallurgical Engineering,* v. 52, June '45, pp. 102-103.

Examines the sub-zero behavior of Al, Cu, Ni, Pb and their alloys and stainless steel; there are several which qualify as structural materials for low temperature processes.

3-121. **Minor Metals.** A. R. Powell.. *Metal Industry,* v. 66, June 29, '45, pp. 406-408.

Thorium; titanium; zirconium; tantalum; niobium. In this survey of the minor metals is the employment of tantalum tube and sheet for service under severe corrosion conditions, and the suggestion that even this metal may eventually be replaced by niobium.

3-122. **Low Carbon Ferro-Titanium.** *Vancoram Review,* v. 4, Spring '45, pp. 10, 21.

Increasing use for titanium in both its customary roles; modifying the condition of oxygen and nitrogen (or their compounds) and imparting desirable properties to alloyed irons and steels for special uses.

3-123. **Manganese-Vanadium Steel.** *Vancoram Review,* v. 4, Spring '45, pp. 11-12.

Combination of physical properties and workability provides an answer to many problems of modern boiler construction.

3-124. **Effect of Grainal Treatment on Steel Made to Specification NE 9440.** *Vancoram Review,* v. 4, Spring '45, pp. 14-15, 17.

Effect of the addition of Grainal on the Jominy hardenability, tensile properties, and impact strength (including tests at low temperature) of a steel made to NE specification 9440.

3-125. **Graphitization of Steel.** H. J. Kerr and F. Eberle. *Iron & Steel,* v. 18, June '45, pp. 186-188.

Investigations on low carbon and low carbon molybdenum types; creep test; arc welded intermediate C-Mo steel.

3-126. **Hipersil—a Greatly Improved Transformer Iron.** T. D. Yensen. *Journal of Applied Physics,* v. 16, July '45, pp. 379-385.

Hipersil is a silicon-iron alloy that, by a combination of hot and cold rolling processes, followed by a refining annealing process has reached such superior magnetic properties, as to cause as great improvements in present day transformer iron as were obtained at the time of the introduction of silicon iron. Hipersil has cut the losses to ¼ of those of Hadfield's alloy, with ten times the maximum permeability.

3-127. **Techniques for Evaporation of Metals.** Leonard O. Olsen, Charles S. Smith and E. C. Crittenden. *Journal of Applied Physics,* v. 16, July '45, pp. 425-434.

Thirty-four elements observed for evaporation behavior, the results summarized for each element and the best techniques then listed.

3-128. **Beryllium Copper.** L. Sanderson. *Aircraft Production,* v. 7, June '45, pp. 287-288.

Survey of the treatment and properties of a useful spring material.

3-129. **Solidification of Metals.** Harry A. Schwartz. American Foundrymen's Association, Third Annual Foundation Lecture Publication No. 45-1, 78 pp.

Most of the problems connected with the solidification of metal, both in the abstract sense and in the sense of making solid castings, can be solved by the application of classic principles of physics. The existing difficulties arise out of the experimental handicaps in determining some of the constants involved, and out of the mathematical difficulty incident to evolving solutions corresponding to the rather complex cases occurring in the most ordinary foundry practice. What is really the most fundamental engineering problem in the foundry industry—the making of castings—has been almost neglected. 38 ref.

3-130. **Reinforced Cast Iron.** R. Bertschinger. *Schweizer Archiv,* v. 10, no. 7, July '44, pp. 195-203. *Engineer's Digest* (American Edition), v. 2, June '45, pp. 273-277.

Compressive strength of cast iron is greatly superior to its tensile strength and may be five to six times as large as the latter. Other considerations are the improvement of the elasticity of cast iron in order to obtain a product which combines the favorable sliding friction properties of cast iron with a good degree of resiliency.

3-131. **Alloy Cast Iron Developments.** Marcel Guedras. *Mecanique,* no. 322, Feb. '44, pp. 39-42. *Engineer's Digest* (American Edition), v. 2, June '45, pp. 277-279.

Alloying elements and their effect on graphitization; use of alloy cast irons in engineering; resistance to chemical agents; manufacture of alloy cast irons.

3-132. **Cast Alloy Alufont-3.** R. Irmann. *Technische Rundschau,* v. 36, '44, no. 29, p. 1; no. 30, p. 2; no. 31, p. 3. *Engineer's Digest* (American Edition), v. 2, June '45, pp. 285-289.

Aluminum-magnesium alloys Peraluman-3 and Peraluman-5 possess excellent corrosion resistance to sea water, but only average mechanical strength. Higher strength and good corrosion resistance are combined in the Anticorodal and Silumin alloys. Alufont-3 possesses the identical strength as Anticorodal and Silumin but combines a far superior elongation with a somewhat lower yield point.

3-133. **Strong, Light Iron Castings.** W. M. Albrecht. *Metals & Alloys,* v. 21, June '45, pp. 1631-1636.

Structurally a cross between a pearlitic malleable iron and a spheroidized high carbon steel, the cast engineering material known as "Z-Metal" offers an interesting combination of properties to the designer

and has developed many important applications which are reviewed.

3-134. **Engineering Properties of Malleable Iron Castings.** *Metals & Alloys,* v. 21, June '45, pp. 1667, 1669.

Types; engineering specifications; heat treatments; properties; trade names.

3-135. **The Solubility of Certain Metals in Gold.** E. A. Owen and E. A. O'Donnell Roberts. Institute of Metals *Journal,* v. 12, May '45, pp. 213-254.

Purpose of the investigation was to obtain data, concerning maximum solid solubility, which could be compared with those obtained with copper and silver, with a view to arriving at a better understanding of the phenomena that occur when metals alloy with one another. Deals with only small portions of most of the equilibrium diagrams of the alloy systems concerned, as attention is directed solely to the α-solid solutions. Solutions in gold of the following elements have been examined: Beryllium, aluminum, zinc, gallium, germanium, arsenic, cadmium, indium, tin, antimony, mercury, lead, and bismuth. 24 ref.

3-136. **The Effect of Some Variations in Melting Procedure on the Properties of High Tin Bronze Chill-Cast Under Controlled Conditions.** W. T. Pell-Walpole. Institute of Metals *Journal,* v. 12, May '45, pp. 267-277.

Effects of some variations in melting conditions and procedure on the properties of small strip ingots of 14% tin bronze, chill-cast under closely controlled conditions. The high tin content was selected as being near to the limit of the normal working range (α-solid solution) and therefore likely to be most sensitive to the effects of such variations. 5 ref.

3-137. **Aluminum-Base Casting Alloys (Materials Work Sheet).** *Machine Design,* v. 17, July '45, pp. 149-153.

Properties; constants; characteristics; applications; fabrication; resistance to corrosion; galvanic corrosion; analyses; material designations.

3-138. **The Examination of a Rimming-Steel Ingot Containing 0.2% of Carbon.** T. Swinden. *Blast Furnace & Steel Plant,* v. 33, July '45, pp. 835-837.

Ingot of 0.29% carbon steel has several features which differ from those of a normal low carbon rimming-steel ingot, such as the unusual appearance of the rimming action, the presence of columnar crystals and the variation in carbon content; provides a definite answer to the question as to whether the iron in the rim portion has been deposited as β-iron. (From British Iron & Steel Institute).

3-139. **Only a Diamond Is Harder.** *Compressed Air Magazine,* v. 50, July '45, p. 192.

"Norbide" is a superior material for lining nozzles used in pressure blasting with sand, steel, grit, or other abrasives, for which it is especially suited because of its great resistance to abrasion; in lapping or polishing of metal parts it acts as an abrasive.

3-140. **Metallurgy of Foreign Automotive Material.** J. H. Frye. *SAE Journal,* v. 53, Aug. '45, pp. 450-479.

Detailed technical knowledge of enemy weapons useful not only because of the tactical benefits involved, but also because of improvements in design that may be used to advantage. Raw materials supply situation of both Germany and Japan, and analysis of parts and processes involved in producing several of their weapons.

3-141. **Titanium in Chrome-Manganese Stainless Steel.** G. F. Comstock. *Iron Age,* v. 156, Aug. 9, '45, pp. 62-66.

Points out valuable rôle of titanium in austenitic 17% manganese, 12% chromium stainless steels; a rôle which heretofore had been only in part surmised.

3-142. **Fundamental Alloying Nature of Magnesium.** Louis A. Carapella. *Metal Progress,* v. 48, Aug. '45, pp. 297-307.

Reviews fundamental principles of alloying behaviors of magnesium to ascertain fully the nature and deportment of magnesium in combination with other metals and to acquire a working knowledge by which certain physical properties can be predicted for a given alloy combination, or by which new magnesium alloys can be fabricated with certain desirable physical properties. 20 ref.

3-143. **Metals for High Temperature Service.** *Industrial Heating,* v. 12, July '45, pp. 1209-1210, 1214, 1230.

Ferrous metals for applications involving resistance to high temperatures, and creep, recovery and relaxation of oxygen-free copper.

3-144. **Creep Resistant Alloy Steels.** *Iron Age,* v. 156, Aug. 2, '45, pp. 58-63.

Behavior of alloy steels at prolonged elevated temperatures shows that the addition of molybdenum to steel imparts high heat strength. Vanadium has a similar reaction in steel alloys but to a lesser degree. Comparative effect of other alloying agents like chromium, nickel, manganese and silicon on physical properties is also included. (From *Stal,* nos. 3 and 4, 1943, pp. 42-47.)

3-145. **Non-Rusting Steels.** A. M. Samarin. *Iron & Steel,* v. 18, July '45, pp. 226-229.

Effect of high nitrogen content on properties. 2 ref.

3-146. **The Modern Metallurgy of Some Wrought Copper Alloys.** R. H. Harrington. *General Electric Review,* v. 48, Aug. '45, pp. 41-49.

Wider knowledge of cold working and heat treatment gives promise of new engineering applications of commercial copper alloys.

3-147. **High Tensile Steel for Castings.** W. West, C. C. Hodgson and H. O. Waring. *Metallurgia,* v. 32, June '45, pp. 75-79.

Aspects of steel making and foundry practice, investigated in connection with the production of medium and high tensile steel castings. Types of steels were of the low and medium alloy varieties capable of giving ultimate tensile strengths from 35 to 65 tons per sq. in. on sections up to 4 in., or as high as 75 tons

per sq. in. on smaller sections, accompanied by good ductility and resistance to impact.

3-148. **Effect of Overaging Aluminum.** *Light Metal Age,* v. 3, July '45, pp. 15, 31, 39, 41.

Illustrates the extent of the adverse effects of overaging high strength aluminum alloy sheet on physical properties and corrosion resistance.

3-149. **Technical Cohesive Strength.** *Metal Industry,* v. 67, Aug. 3, '45, p. 73.

Factors which determine cessation of plastic deformation. 1 ref.

3-150. **Effect of Heat Upon Residual Stresses.** La Motte Grover. *Iron Age,* v. 156, Aug. 16, '45, pp. 62-69.

Simple analyses to illustrate the actions of expansion, contraction, and elastic and plastic deformations resulting from the heating and cooling of mild steel; also the effects of these actions upon residual stresses and distortion. These actions and their effects are of significance in connection with such processes as welding, local stress relieving by any method involving heating, "flame straightening" to remove buckles or other distortion, preheating, postheating, local heating for bending or flanging, and other operations involving local heating, particularly if it is applied over a considerable length of material or if it is of a continuous, progressive nature.

3-151. **Automotive Bolts.** A. S. Jameson. *Iron Age,* v. 156, Aug. 23, '45, pp. 64-69.

Materials for automotive bolts must combine the properties of plasticity and high yield strength. Since these two properties are in opposition to each other, a compromise must be made in selecting the best functioning material. Properties of low and medium carbon steels and alloy steels as applied to the fabrication of bolts by hot forming or cold heading are discussed.

3-152. **Oxide-Metal Layers Formed on Commercial Iron-Silicon Alloys Exposed to High Temperatures.** Raymond Ward. *Metals Technology,* v. 12, Aug. '45, T.P. 1832, 15 pp.

Presents the effect of composition, temperature, time, and atmosphere on the type of scale-metal layer obtained and gives some qualitative indication of the effect of these variables on the rates of oxidation. 6 ref.

3-153. **Creep Properties of Some Binary Solid Solutions of Ferrite.** Charles R. Austin, C. R. St. John and R. W. Lindsay. *Metals Technology,* v. 12, Aug. '45, T.P. 1837, 22 pp.

Describes the results of isolating one microstructural phase, namely ferrite, and studying its creep characteristics in both the unalloyed and alloyed conditions. This should aid in establishing to a large degree the importance of ferrite in the creep behavior of steels consisting of the previously mentioned ferrite-carbide aggregate. 23 ref.

3-154. **Alloy Cast Iron.** *Canadian Metals & Metallurgical Industries,* v. 8, Aug. '45, pp. 37-38.

Role of nickel and associated alloys in improving properties. High test cast irons; abrasion resistance; cast iron at elevated temperatures.

3-155. **Solidification of Metals.** Harry A. Schwartz. ***Foundry,*** v. 73, Sept. '45, pp. 107-108, 210, 212, 214, 216, 218.

Basic principles involved in the transformation of metals from the liquid to the solid state.

3-156. **A Case of Embrittlement of Steel.** *Monthly Review,* v. 32, Aug. '45, pp. 784-786, 845.

A failed zinc plated spring clip exhibited a stained fracture which was found to be partly intercrystalline in character in localized areas adjacent to spot welds. It is probable that clips with sound, non-martensitic welds, which might be obtained by preheating prior to spot welding, would withstand the zinc plating operation without cracking.

3-157. **Aging and Stretching 24S-T Aluminum.** Loyis Ecker. *Iron Age,* v. 156, Aug. '30, '45, pp. 36O-36P.

Three tests were conducted to determine what changes in mechanical properties can be obtained when aluminum alloy 24S-T as-received sheets and extrusions are subjected to aging only, giving 24S-T81; and to a treatment involving 2% stretching plus aging, resulting in 24S-T84.

3-158. **Post-War Alloy Steels.** Edwin F. Cone. *Metals & Alloys,* v. 22, Aug. '45, pp. 392-396.

Survey of the future of alloy steels (and especially of the electric furnace steels) as seen by leading materials engineers and steel mill metallurgists.

3-159. **Do Solid Magnesium Alloys Burn?** Louis A. Carapella and William E. Shaw. *Metals & Alloys,* v. 22, Aug. '45, pp. 415-416.

Positive scientific proof that no fire hazard whatever attaches to the use of solid (massive) magnesium alloys and parts.

3-160. **Free-Machining Open-Hearth Bar Steels.** *Metals & Alloys,* v. 22, Aug. '45, pp. 425-428.

Machining and heat treating characteristics and general properties of the six grades of cold finished low carbon open-hearth bar steels selected by the cold finished bar steel industry as standard materials.

3-161. **Pearlitic Rim in Malleable Iron.** J. E. Rehder. *Canadian Metals & Metallurgical Industries,* v. 8, Aug. '45, pp. 29-31, 45.

Formation due to oxidation of silicon, increasing stability of cementite. 5 ref.

3-162. **Alloy Cast Irons.** *Canadian Metals & Metallurgical Industries,* v. 8, Aug. '45, pp. 37-38.

Role of nickel and associated alloys in improving properties.

3-163. **Nitrogen in Chromium-Nickel Steels.** *Metal Treatment,* v. 12, summer '45, p. 86.

Nitrogen can be used to replace some of the nickel in certain chromium-nickel steels. How this substitution can affect the mechanical and electrical properties of austenitic and austenitic-ferritic chromium-nickel steels is shown. (Translated from *Stahl und Eisen.*)

3-164. **High Tensile Steel for Castings.** W. West, C. C. Hodgson and H. O. Waring. *Metallurgia,* v. 32, July '45, pp. 126-132.

Number of aspects of steel making and foundry practice investigated; types of steels were of the low and medium alloy varieties capable of giving ultimate tensile strengths from 35 to 65 tons per sq. in. on sections up to 4 in., or as high as 75 tons per sq. in. on smaller sections, accompanied by good ductility and resistance to impact.

3-165. **Segregation of Metals and Alloys.** *Metallurgia,* v. 32, July '45, pp. 133-134.
Fundamental principles involved in segregation of alloy castings, factors underlying segregation in steel ingots, the relation of open-hearth practice to segregation in rimmed steel, and segregation in babbitt metal.

3-166. **Light Alloys for Marine Engines.** A. J. Murphy. The American Society of Naval Engineers *Journal,* v. 57, Aug. '45, pp. 399-425.
Characteristics of light alloys which designers will wish to take into account when deciding what role these materials can play in the further development of the marine engine. Pistons; cylinder heads; corrosion; mechanical properties; wrought light alloys; cast light alloys.

3-167. **Metallurgy Reports on the Enemy.** *Aero Digest,* v. 50, Sept. 1, '45, pp. 94, 179-180.
Functional studies; technique not advanced; more work done by hand.

3-168. **Heat and Corrosion Resistant Steels.** R. W. Jones. *Steel Processing,* v. 31, Aug. '45, pp. 489-493.
Required properties for various applications.

3-169. **Tapered-Thickness Bimetal.** William B. Elmer. *Electrical Engineering,* v. 64, Sept. '45, pp. 661T-664T.
Most important properties of thermostatic bimetal strips of uniformly tapered width or thickness or both have been analyzed mathematically, and the findings are described.

3-170. **Carbon Cast Steels—Materials Work Sheet.** *Machine Design,* v. 17, Sept. '45, pp. 153-156.
Properties prescribed in ASTM specifications; characteristics; applications; fabrication; heat treatments; resistance to corrosion; galvanic corrosion; design tips.

3-171. **German Tool and Special Steels.** James P. Gill. *Iron Age,* v. 156, Sept. 13, '45, pp. 54A-54N.
German tool and special steels are described, and analyses of the more popular prewar and war steels are shown.

3-172. **Brittleness and Ductility of Metals at High Temperatures.** W. Siegfried. *Technische Rundschau Sulzer,* 1945, no. 1, pp. 43-79. *Engineers' Digest* (American Edition), Aug. '45, pp. 391-396.
Behavior of a steel under stress at elevated temperature is characterized by two strength values, namely its resistance to deformation and its resistance to fracture. Rapid decrease in the strength of a notched piece may be taken to be due to the same cause responsible for the deformationless failure of notch-free test bars of steel under long-time stress; experiments with tin-cadmium alloys.

3-173. **Improvement of Engineering Carbon Steel.** A. P. Gulyaev and F. M. Halperin. *Stal,* v. 3, 1943, pp. 49-51.

Engineers' Digest (American Edition), v. 2, Aug. '45, pp. 398-399.

Improvement of engineering carbon steel by the addition of small amounts of boron or of grainal. Several experimental heats were prepared in which deoxidation was carried out with the addition of boron, grainal, and aluminum respectively.

3-174. **The Structure of Hard Metal Alloys.** W. Dawihl and J. Hinuber. *Kolloid Zeitschrift*, v. 104, Aug.-Sept. '43, pp. 233-236. *Engineers' Digest* (American Edition), v. 2, Aug. '45, pp. 407-409.

Characteristics responsible for the outstanding abrasion resistance properties of hard metal alloys of the tungsten carbide type with 60% of a low melting metal (cobalt).

3-175. **The Properties of Some Magnesium-Aluminum-Zinc Casting Alloys and the Incidence of Microporosity.** F. A. Fox. Institute of Metals *Journal*, v. 71, Aug. '45, pp. 415-439.

Static mechanical properties of magnesium-aluminum-zinc alloys containing up to 10% of aluminum and 6% of zinc; a similar range of alloys had also been examined for "inherent" tendencies to microporosity, as demonstrated by radiography of an arbitrary flat-plate test casting. The tensile test results show that optimum ranges of composition exist, which differ with the state of the material examined, i.e., whether cast, solution treated, or fully heat treated. Influence of residual β-phase is harmful to the mechanical properties of imperfectly solution treated alloys, but the presence of precipitate in the fully heat treated alloys tends to offset this adverse effect. 9 ref.

3-176. **Non-Equilibrium Structures in Chill-Cast Tin-Antimony-Cadmium Alloys and Their Effects on Mechanical Properties.** W. T. Pell-Walpole. Institute of Metals *Journal*, v. 71, Aug. '45, pp. 441-454.

Alloys containing metastable suppressed β have high mechanical properties in the as-cast form, but on aging at room temperature or at 100° C. their hardness decreases to values lower than those of the same alloys in stable equilibrium. Alloys with 9 to 14% of antimony and 1½ to 10% of cadmium have much higher mechanical properties in the chill-cast condition, when they contain metastable SbSn, than in stable equilibrium, when SbSn is replaced by CdSb. Chill-cast alloys with 7 to 10% of antimony and ½ to 2% of cadmium temper-harden at 140° C., and, owing to the cored condition of the α solid solution, no grain boundary embrittlement occurs as it does when the same alloys are temper-hardened after a preliminary homogenizing treatment. Rolling inhibits this temper-hardening, which can therefore be applied only to castings. 6 ref.

3-177. **High Carbon Steels.** Harold Shaw. *Iron and Steel*, v. 18, Aug. '45, pp. 403-404.

Choice of plant for providing a suitable atmosphere is not altogether a simple matter of first cost and upkeep. Several factors have to be considered, particularly so in the case of high carbon steels. Figures for relative costs of the two possibilities.

3-178. **Cerium.** G. Ahrens. *Modern Metals,* v. 1, Sept. '45, pp. 20-21.

Cerium, more commonly known as mischmetal, has been experimented and used with both aluminum and magnesium as a minor alloying ingredient in this country, England and Germany, in increasing amounts during this war. Difficulties, such as proper alloying methods and accurate analysis of the cast product, have been overcome, and it is possible that the addition of Cerium will become standard in a variety of light alloys because certain properties have definitely been improved upon in both cast and wrought parts. Properties of mischmetal as well as some of the present day applications. 37 ref.

3-179. **Strain-Age Embrittlement.** W. E. Bardgett. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1389-1397, 1417.

Clear exposition of the nomenclature, coupled with a promising method of detecting embrittlement resulting from the straining and aging of strip material. Wholly concerned with basic open-hearth rimming steel.

3-180. **Germany's Tool and Special Steel Industry.** James P. Gill. *Steel,* v. 117, Sept. 24, '45, pp. 120-126, 128, 130, 132, 134, 136, 139, 140, 143.

Details on methods and analyses reveal strong preference for tungsten types and changing compositions.

3-181. **Machinability of Aluminum Alloys.** *Light Metal Age,* v. 3, Sept. '45, pp. 8-9, 32, 42, 44.

Discusses the machinability of aluminum alloys from the standpoint of their metallurgy. Describes the effect of alloying constituents and heat treatment upon the machinability of aluminum alloys. Recommendations are made as to machining practice. 28 ref.

3-182. **Cerium—Light Metal Alloys.** *Light Metal Age,* v. 3, Sept. '45, pp. 21-22, 32.

Application of cerium mischmetal with aluminum and magnesium alloys; information heretofore has been somewhat sketchy and uncorrelated. Up-to-date summary. Information annotated giving references and sources of information. 37 ref.

3-183. **Measuring Wire Stiffness by Low Stress Elongation.** C. B. Shopmyer. *Wire & Wire Products,* v. 20, Oct. '45, pp. 752-753, 756.

One of the most important properties of magnet wire is its softness or windability. Discusses in a very general way some of the methods of measuring this property.

3-184. **Condensed Review of Some Recently Developed Materials.** *Machinery,* v. 52, Oct. '45, pp. 173-183.

Arranged alphabetically by trade names.

3-185. **18:8 Stainless Steel.** Herbert H. Uhlig. *Iron & Steel,* v. 18, Sept. '45, pp. 417-420.

Comparative effect of carbon and nitrogen on intergranular corrosion.

3-186. **High Silicon Aluminum Alloys—Their Casting and Heat Treatment.** F. A. Allen. *Light Metals,* v. 8, Sept. '45, pp. 431-434.

Development, theory, and foundry techniques for the

successful use of the eutectic aluminum-silicon alloys. Comments upon the modification process.

3-187. **The Machinability of Metals.** J. Stoney. *Machinery* (London), v. 67, Sept. 6, '45, p. 276.

Heat treatment; quenching; the use of C, S, P, and Mn in steel; hardness due to cold-working.

3-188. **Structural Changes in Carbon and Molybdenum Steels During Prolonged Heating at 900 to 1000° F.** G. V. Smith, R. F. Miller and C. O. Tarr. *Combustion*, v. 17, Sept. '45, pp. 41-44. Also *Steel Processing*, v. 31, Sept. '45, pp. 582-584.

Results of investigations on three carbon and six molybdenum steels at temperatures from 900 to 1100° F. over periods ranging up to 5000 hr., each being tested in both annealed and normalized conditions and their hardness and microstructure observed. Rate of spheroidization was greater in the normalized steels, but less marked in the carbon steels. Graphite formed in all the carbon steels, but only in those molybdenum steels to which aluminum had been added.

3-189. **Magnesium Today.** Thur Schmidt. *Modern Metals*, v. 1, Oct. '45, pp. 4-6.

Wartime magnesium applications and points out definite advantages of magnesium. Cautions fabricators about wishful thinking and avoidance of misapplications.

3-190. **Wrought Magnesium—Alloys, Properties, Fabrication and Uses.** E. S. Bunn. *Metal Progress*, v. 48, Oct. '45, pp. 708-712.

Alloying elements; commercial wrought alloys; fabrication methods; physical properties; design characteristics.

3-191. **Effects of Boron in Steel.** R. B. Corbett and A. J. Williams. *Iron Age*, v. 156, Oct. 11, '45, pp. 54-57.

Study of the properties imparted to steels by boron additions led to the conclusion that the most important effect of the proper use of boron is to increase the hardenability of steel that is used in the quenched condition without tempering or with only slight tempering. Neither the hardness nor any other property of a steel is materially improved by treatment with boron if the steel is normalized. (Bureau of Mines Report of Investigations 3816.)

3-192. **Characteristics of Wrought Aluminum Alloys.** Owen Lee Mitchell. *American Machinist*, v. 89, Oct. 11, '45, pp. 99-105.

Factors involved in selection of wrought aluminum alloys for a specific product vary widely with deviations in the end use and the manufacturing steps in its fabrication.

3-193. **Relative Curvature Controls Gear Tooth Surface Strength.** Ernest Wildhaber. *American Machinist*, v. 89, Oct. 11, '45, pp. 118-121.

Indicates that magnification of small tooth surface portion gives simple basis for a broader analysis.

3-194. **The Strength of Alclad D.T.D. 390.** I. G. Bowen. *Aircraft Engineering*, v. 17, Aug. '45, pp. 240-241.

Proportionality limit; 0.1% proof stress; 0.2% proof stress; 0.5% proof stress; ultimate tensile strength; elongation on 2 in.

3-195. **Low Temperature Behavior of Ferritic Steels.** *Iron Age,* v. 156, Oct. 4, '45, pp. 69-71, 154, 156, 158.

Guns and armor sometimes have to operate at $-50°$ F.; aircraft may operate at temperature approaching $-100°$ F., and in equipment for low temperature processing of petroleum products and synthetic rubber, for example, temperatures of $-300°$ F. or below may be required. The engineering questions raised by the low temperature behavior of steels gave rise to a research program under War Metallurgy Committee guidance. Results of experimental work on effect of composition, heat treatment, grain size, and hardenability summarized for both NE and SAE steels. Low temperature behavior of NE steels is equivalent to that of NE provided an equally fine-grained, equally hardenable steel is used.

3-196. **Aluminum Alloy R303.** Paul P. Zeigler, L. E. Householder and H. N. Logsdon. *Iron Age,* v. 156, Oct. 4, '45, pp. 74-78.

New high strength alloy, with a well-balanced set of mechanical and general corrosion resistant properties, will likely find many postwar applications. Physical properties, heat treatment, etching techniques, corrosion characteristics, and formability are all described.

3-197. **"Kumium."** *Machinery* (Lloyd), v. 17, Sept. 1, '45, p. 69.

Heat treatable corrosion resisting copper-chromium alloy has a wide range of physical properties.

3-198. **Which Steel Shall I Use?** H. W. Gillett. *Machine Design,* v. 17, Oct. '45, pp. 101-108.

Deals with the frame of mind in which the machine designer should seek information regarding what steel to use. Discusses how section size influences characteristics; stress gradient falls sharply; boron-treated steels improve hardenability; fine-grained steels are tougher; hardenability should be specified.

3-199. **Cast Nickel Alloy Steels. (Materials Work Sheet.)** *Machine Design,* v. 17, Oct. '45, pp. 167-172.

ASTM specifications; properties prescribed in ASTM specifications; characteristics; applications; fabrication; heat treatments; resistance to corrosion.

3-200. **Effect of Exhaust Gases on Stainless Steel Manifolds.** Wilson G. Hubbell. *Automotive Industries,* v. 93, Sept. 15, '45, pp. 30-32, 67-68.

As a result of the conflicting information available concerning the effect of stabilizing and stress relief heat treatment upon welded 18-8 stainless steel, series of investigations was made on this subject. Determines the particular benefit, if any, which might be imparted by these processes to 18-8 types 321 and 347 stainless steels for use on exhaust manifolds. Benefits which would be reflected in greater serviceability of the aircraft exhaust manifolds manufactured from this steel were of prime importance to this inquiry.

3-201. **Beryllium-Copper—Some Processing Characteristics.** George H. Slagle. *Metals & Alloys,* v. 22, Sept. '45, pp. 731-734.

Some suggestions for specifying and fabricating beryllium-copper, based on years of practical experience with the alloy.

3-202. **New Uses for Cerium.** G. Ahrens. *Metals & Alloys,* v. 22, Sept. '45, pp. 748-750.

Applications of cerium for making stronger, better aluminum and magnesium parts and other engineering materials.

3-203. **Metallurgical Aspects of the Failure of Colliery Haulage and Winding Gear.** J. H. Woodhead. *Iron & Coal Trades Review,* v. 150, no. 4027, May 4, '45, pp. 659-664, 674. *Engineers' Digest* (American Edition), v. 2, Sept. '45, pp. 462-464.

Choice of materials for haulage and winding gear is limited by the necessity for good ductility and high resistance to shock combined with adequate strength. Ease of working by the blacksmith and absence of any necessity for complicated and critical heat treatment are also important. Mild steel containing about 0.1 to 0.15% carbon and 1.5% manganese has properties which make it an extremely good material for the construction of haulage and winding gear. This steel has an unusually high shock resistance and retains its mechanical properties well in service.

3-204. **How to Conserve Tool Steel and Obtain Longer Tool Life.** Robert C. Gibbons. *Steel,* v. 117, Oct. 22, '45, pp. 112-113, 150, 152, 154, 156-157.

Practical suggestions on selection of tool steels, design and preparation of tools, design of the part, method of manufacture and previous treatment of the metal machined.

3-205. **Iron-Manganese Alloys: The Properties of Cold-Worked and Heat Treated Alloys Containing 1 to 7% Manganese.** R. S. Dean, J. R. Long, T. R. Graham and R. G. Feustel. American Society for Metals Preprint 5, 1945, 22 pp.

Properties of material reduced 20, 40, 60, and 80% in thickness by cold rolling are reported. In the soft condition the tensile strength is increased by about 11,000 psi. for each 1% manganese. Cold working to 80% reduction produces a tensile strength of 192,600 psi., an elongation of 2.7% in 2 in., and a hardness of Rockwell C-38. Normalizing and annealing of cold-worked material produces essentially the same properties for a given temperature of treatment. Tempering of normalized material produces minimum strength and hardness independent of normalizing temperatures. 7 ref.

3-206. **New Aluminum Alloys Containing Small Amounts of Beryllium.** R. H. Harrington. American Society for Metals Preprint 12, 1945, 14 pp.

These new heat treatable compositions are of two types: (a) Aluminum-copper-beryllium with the copper and beryllium in the critical ratio of 7 to 1, and (b) Aluminum-copper-beryllium-cobalt with the cobalt and beryllium in the critical ratio of 6.5 to 1. Alloys develop supe-

rior strength properties as castings made by gravity-sand, centrifugal, and lost-wax methods combined with high thermal stability and unusual oxidation-corrosion resistance. They also develop useful wrought properties so that it is possible for one representative composition to meet requirements in both fields.

3-207. **Effect of Nickel on Physical Properties and Thermal Characteristics of Some Cast Chromium-Molybdenum Steels.** N. A. Ziegler and W. L. Meinhart. American Society for Metals Preprint 28, 1945, 41 pp.

Experimental evidence of the effect of nickel (up to 2%) on thermal characteristics and physical properties of steels containing 2.5% chromium, 0.5% molybdenum, up to 9% chromium, 1.5% molybdenum and 0.05 to 0.3% carbon. 49 ref.

3-208. **Tailoring 18-8.** Wilson G. Hubbell. *Western Machinery and Steel World,* v. 36, Oct. '45, pp. 446-451.

Brief discussion of some of the properties of stainless steels with respect to their use in aircraft production.

3-209. **Processing and Fabrication of Stainless Steel Sheet and Plate Products.** H. S. Schaufus and W. H. Braun. *Steel Processing,* v. 31, Oct. '45, pp. 625-629.

Deals with the chromium-nickel stainless steel group and its related alloys. Describes their chemical compositions, microstructures and physical properties.

3-210. **Aging of 75S Aluminum Alloys.** William L. Fink, J. A. Nock and M. A. Hobbs. *Iron Age,* v. 156, Nov. 1, '45, pp 64-67.

Various aging treatments on 75S alloy, and their effects on the workability of the metal are described. Descriptions are given of the dimpling capacity, tensile properties, corrosion resistance and effects of cold working after quenching and before aging.

3-211. **Correlation of Mechanical Properties and Corrosion Resistance of 24S Type Aluminum Alloys as Affected by High Temperature Precipitation.** W. D. Robertson. *Metals Technology,* v. 12, Oct. '45, T.P. 1934, 12 pp.

It is shown that the effect of precipitation time and temperature on both the initial change and ultimate maximum mechanical properties and initial, maximum and ultimate susceptibility to intercrystalline corrosion of 24S type aluminum alloys can be expressed by an equation of the form: $t = K \cdot 10^{m/T}$. Because initial changes in properties may be expressed by this equation it is possible to define the time and temperature permissible in high temperature applications, especially with regard to the initial susceptibility to intercrystalline corrosion. 7 ref.

3-212. **Low Expansion High Nickel Alloy for Precision Parts.** F. G. Sefing and D. A. Nemser. *Product Engineering,* v. 16, Nov. '45, pp. 799-801.

Engineering properties of a casting alloy having low thermal expansion and the factors to be considered in using this alloy in precision machines and equipment are discussed. Curves showing mean coefficients of expansion are included.

3-213. **Vanadium Data Sheet—Wrought Vanadium Constructional Steels in Heavy Sections.** *Vancoram Review,* v. 4, Summer, '45, pp. 14-15, 17.

Groups include wrought vanadium constructional steels in heavy sections, wrought vanadium steel in light sections, vanadium spring steels, and wrought vanadium tool steels. Analysis; treatment; properties; uses of each.

3-214. **Manganese-Molybdenum-Vanadium Cast Steel.** *Vancoram Review,* v. 4, Summer, '45, pp. 11, 20-21.

Minimum yield strengths between 95,000 and 150,000 psi. with minimum reduction of area values between 40 and 30% are being met consistently for various specifications. These exceptionally high tensile properties are obtained with a water quench followed by a tempering treatment well over 1000° F., even for the highest strengths, thus relieving all quenching strains and raising the ductility and the resistance to impact.

3-215. **Properties and Characteristics of Common Magnesium Casting Alloys.** J. D. Hanawalt, C. E. Nelson and R. S. Busk. *American Foundryman,* v. 8, Oct. '45, pp. 39-48.

Assists founder, manufacturer, and design engineer in the problem of choosing the alloy most favorable for their particular application. Part I presents pertinent technical data. Part II attempts to weigh these facts and to draw from them some practical working conclusions. Table presents the nominal compositions of the alloys covered together with designations commonly used in the United States and abroad. 16 ref.

3-216. **Selecting the Proper Heat Resistant Steel.** R. A. Lincoln. *Iron Age,* v. 156, Nov. 8, '45, pp. 74-77.

Characteristics of chromium-nickel steels are described, along with an evaluation as to their capabilities and limitations under varying service conditions.

3-217. **Wrought Heat Resisting Alloys for Gas Turbine Service.** C. T. Evans. *Metal Progress,* v. 48, Nov. '45, pp. 1083-1095.

Metallurgy involved in development and application of these materials reviewed. Compilation made of the significant properties of the older alloys which are not under secrecy restrictions, many of which can be used in parts of the new structures. "Base line" data presented so that engineers can readily see if there is any possibility of using them in contemplated structures requiring service at high temperature and definite loadings, and so that the newer alloys can be properly evaluated and compared by metallurgists and the designing engineers working on gas turbines and machines for other types of severe service.

3-218. **Factors Affecting the Hardenability of Boron-Treated Steel.** R. A. Grange and T. M. Garvey. American Society for Metals Preprint 10, 1945, 40 pp.

Increase in hardenability due to boron is correlated with the boron content and with the amount of a characteristic constituent which appears in boron-treated steels after special heat treatment. The increase in hardenability decreases with increasing carbon content; the implication is that boron will not increase the hardenability of hypereutectoid steel.

3-219. **Manganese Alloy Cast Steels (Materials Work Sheet).** *Machine Design,* v. 17, Nov. '45, pp. 157-162.

Properties prescribed in ASTM specifications; characteristics; applications; fabrication; heat treatments.

3-220. **The Influence of Liquids Upon the Strength of Glass & Hardened Steel.** C. Benedicks and G. Ruben. *Engineers' Digest* (American Edition), v. 2, Oct. '45, pp. 485-486. *Jernkontorets Annaler,* v. 129, 1945, pp. 37-106.

There exists evidence that the surrounding medium may be of considerable influence upon the properties of the material itself. Water decreases the strength of steel by some 22%, while wetting by aliphatic hydrocarbons and by such materials as anti-corrosion oil and lubricating oil actually increases the strength as compared to the strength recorded in air.

3-221. **Metallurgy of Copper and Its Relation to Magnetic Wire Manufacture.** W. L. Fleischmann. *Wire & Wire Products,* v. 20, Nov. '45, pp. 853-857.

Tables give rupture strength; chemical analysis of copper as listed and typical analysis of copper today and 20 years ago. 12 ref.

3-222. **Elastic Properties of Steel Wire Intended for Springs and Formed Parts.** N. C. Talmadge. *Wire & Wire Products,* v. 20, Nov. '45, pp. 859-861, 884.

Results of tests indicate that cold drawn wire with a yield point between 55 and 75% of its tensile could be formed or coiled into springs or other parts uniform in shape and size. Wire with higher yield strengths, from 80 to 90% of their tensiles, resulted in non-uniform products or required frequent adjustment of the forming tools in order to maintain passable uniformity of the product.

3-223. **New Temperature and Stress Resisting Alloys.** *Blast Furnace & Steel Plant,* v. 33, Nov. '45, p. 1379.

Many facts about these new alloys are shrouded in military secrecy. It can be said, however, alloys have been developed to withstand stresses in the neighborhood of 15,000 psi. at temperatures up to about 1,500° F. Life is dependent on creep resistance and, in many applications, also upon corrosion resistance.

3-224. **Copper as an Alloy in Iron and Steel.** G. K. Manning and P. C. Rosenthal. *Mining & Metallurgy,* v. 26, Dec. '45, pp. 601-605.

Some unique advantages and some limitations.

3-225. **Cooling Characteristics of Steel and Aluminum-Finned Cylinder Barrels for In-Line Air-Cooled Engines.** Marcel Piry. *SAE Journal,* v. 53, Nov. '45, pp. 630-639.

Comparative cooling tests were conducted with two cylinders, one provided with a conventional, steel-finned barrel, the other with an aluminum-finned barrel in which fins were milled from an aluminum muff integrally bonded to the steel liner. Both cylinders were provided with the same cast aluminum head. At rated horsepower and equal cooling conditions the average temperature of the aluminum-finned barrel was 58° F. lower than that of the steel-finned barrel.

3-226. **New Bismuth Alloys Developed to Find Market for the Metal.** Walter C. Smith. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 561-562.

A number of alloys have been standardized and those most widely used are described.

3-227. **Which Grade of Free-Machining 18-8 Stainless.** *Screw Machine Engineering,* v. 7, Nov. '45, pp. 77-80.

Difference in properties between 18-8 FM-sulphur and 18-8 FM-selenium; identification of 18-8 FM-sulphur or 18-8 FM-selenium; need for unprejudiced mind when considering the stainless alloys.

3-228. **Cast Steels—Chromium and Molybdenum Alloy Types.** *Machine Design,* v 17, Dec. '45, pp. 155-160.

Properties prescribed in ASTM specifications; characteristics; applications; fabrication; resistance to corrosion; heat treatments; material specifications.

3-229. **Copper-Base Compacts.** F. R. Hensel. *Metal Industry,* v. 67, Nov. 2, '45, pp. 281-285.

Results of the investigations indicate that excellent physical and electrical properties can be obtained with age-hardening copper alloys containing chromium, cobalt and beryllium. Addition of small percentages of phosphorus and titanium hydride is beneficial in such alloys. (From *Metals Technology.*)

SECTION IV

STRUCTURE

Metallography and Constitution

4-1. X-Ray Measurement of Order in the Alloy Cu_3Au. Zigmond W. Wilchinsky. *Journal of Applied Physics,* v. 15, Dec. '44, pp. 806-812.

X-ray diffraction theory is developed for the evaluation of long range order and short range order in the alloy Cu_3Au, and experiments are described whereby each type of order was measured. Values of the long range order parameter S were found to be 0.86 for 250° C, 0.81 for 370° C, and 0.79 for 380° C, the samples being held at elevated temperatures during the X-ray exposures. At the critical temperature $T_c = 388°$ C, S suddenly dropped to zero.

4-2. Tessellated Stresses, III. F. Laszlo. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 758-762.

Characteristic stresses; cubic metal crystals; hexagonal metal crystals; surface intersections; crack formation; thermal constants; modification of tessellated stresses; density.

4-3. Magnesium Alloy Metallography. *Iron Age,* v. 155, Feb. 1, '45, pp. 58-59.

To facilitate the preparation of magnesium alloy specimens for metallographic study, the procedure described herein was developed by the Dow Chemical Co. Etchant formulas and a description of the microscopic appearance of the chief structural features of the commercial alloys are included as an aid to the inexperienced metallographer.

4-4. The Orientation Texture at the Surface of Cast Metals. Gerald Edmunds. *Metals Technology,* v. 12, Jan. '45, T. P. 1773, 1 p.

A zinc casting solidified against a molten lead surface was found to have the same surface orientation texture (001), parallel to the surface, as other zinc and cadmium castings. Aluminum and alpha-beta brass die castings were found to have random grain orientation textures at the surface.

4-5. A Further Note on the Microstructure of High-Silicon Acid-Resisting Iron. J. E. Hurst and R. V. Riley. Iron and Steel Institute Advance Copy, Dec. '44, 5 pp.

Silicon or its compounds, either in the etching reagent or in the specimen, are essential to the formation of the barley-shell structure and have to be taken into consideration in any explanation of its exact nature.

4-6. **Equilibrium Diagrams.** *Metal Industry,* v. 66, Jan. 26, '45, pp. 57-58.

Critical survey of the tools of research; Al-Zn system; Cu-Sn system. 3 ref.

4-7. **Metallographic Examination.** P. F. George. *Metal Industry,* v. 66, Feb. 2, '45, pp. 66-68.

Routine examination of magnesium alloys described in paper presented to the American Society for Testing Materials; includes the specimen preparation, etching technique, and a rating system for recording the microstructure as a series of numbers.

4-8. **Metallographic Examination.** P. F. George. *Metal Industry,* v. 66, Feb. 9, '45, pp. 87-91.

Rating charts for massize compound, "pearlitic" precipitate, porosity and "burning" for cast magnesium alloys, grain size chart and a rating chart for massive compound in wrought alloys.

4-9. **X-Ray Diffraction Examination of Gamma Alumina.** M. H. Jellinek and I. Fankuchen. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Feb. '45, pp. 158-163.

Controlled heating experiments have been made on γ-alumina, and the products studied by both wide-angle and low-angle X-ray scattering methods. New lines in the wide-angle diagrams suggest a different unit cell from the accepted one. Both of these methods are used to evaluate crystallite and particle size. 13 ref.

4-10. **Ac_3 Point in Iron.** John K. Desmond. *Iron and Steel,* v. 18, Feb. '45, pp. 55-56.

Determination by a grain elimination method.

4-11. **Ar″ in Chromium Steels.** Eugene P. Klier and Alexander R. Troiano. *Metals Technology,* v. 12, Feb. '45, Tech. Pub. 1799, 11 pp.

Effect of chromium on Ar″ determined for 17 steels covering a wide range of compositions. Microstructure of martensite. Several of the steels were extremely sensitive to stabilization. Stabilization can occur without previous decomposition of austenite to martensite or any of the other decomposition products. 23 ref.

4-12. **Recrystallization of Aluminum in Terms of the Rate of Nucleation and the Rate of Growth.** W. A. Anderson and R. F. Mehl. *Metals Technology,* v. 12, Feb. '45, Tech. Pub. 1805, 28 pp.

Measurements made of the recrystallization of cold-worked high purity aluminum in sheet 0.015 in. thick. In terms of isothermal recrystallization rate curves, and in terms of the rate of nucleation, rate of crystallization (N) increases with decrease in initial grain size. Studies at high degrees of deformation, 90% by cold-rolling, suggest that N initially increases with time. Evidence is good that recrystallization nuclei form at points of high stress. 24 ref.

4-13. **The Structure of the Nitride Case on an Austenitic Steel.** W. Betteridge. *Journal of Scientific Instruments,* v. 22, Feb. '45, pp. 28-29.

The nitrogen case hardening of an austenitic steel was not successful by the normal methods, the hardened surface being spoiled by flaking of the outer layers of the case. Crystallographic examination showed that this was due to the presence of Fe_4N, which, in addition to flaking away, was softer than the underlying layers of γ solid solution. Modification of the nitriding method enabled the formation of Fe_4N, with the consequent flaking, to be avoided.

4-14. **The Crystal Grain Orientation in a Rolled Magnesium Alloy.** A. Hargreaves. Institute of Metals *Journal,* v. 71, Feb. '45, pp. 73-86.

Preferred orientation of the crystal grains in Elektron AM503 alloy sheet has been examined by X-ray methods. In the surface of the sheet the basal plane normals (0001) of the crystal grains are normal to the plane of the sheet, but in the center of the sheet they tend to align themselves along one of two most probable directions inclined at approximately 15° on either side of the normal to the sheet and lying in the plane containing the rolling direction and the sheet normal. There is a gradual transition from one type of basal plane orientation to the other on passing from the surface to the center of the sheet. The hexagon edges (1120) of the crystal grains are oriented parallel to the rolling direction in the surface of the sheet, but are oriented at random about the (0001) axes in the central regions of the sheet. 13 ref.

4-15. **Solution of the Diffusion Equation Applicable to the Edgewise Growth of Pearlite.** W. H. Brandt. *Journal of Applied Physics,* v. 16, March '45, pp. 139-146.

Diffusion equation is transformed to a set of coordinates moving with the pearlite interface and a solution applicable to the problem obtained in the form of an infinite series of terms. Using the first three terms, the edgewise velocity of pearlite growth is calculated for a plain carbon eutectoid steel using data most of which are obtained by extrapolation. The values obtained show reasonable agreement with values for the rate of pearlite nodule growth determined by Hull, Colton, and Mehl. The velocity increases with decreasing temperature, as expected, and it is shown that this is caused by the change in the solubilities of ferrite and cementite in austenite with temperature. The theory predicts curved ferrite-austenite and cementite-austenite interfaces and the carbon concentration in austenite is shown to vary across each of these interfaces.

4-16. **Estimating Temperatures Causing Damage to Plain Low-Carbon Steel Tubes.** Richard C. Corey. *Combustion,* v. 16, March '45, pp. 40-43.

Reviews the principal causes of tube failures and discusses how the probable temperature to which they have been subjected can be estimated by means of metallographic examination of microstructure changes.

The basis of such studies is explained and limitations pointed out.

4-17. **Standards for Identifying Complex Twin Relationships in Cubic Crystals.** C. G. Dunn. *Metals Technology,* v. 12, April '45, T.P. 1796, 8 pp.

Method of computing orientation of a twin. 6 ref.

4-18. **Orientation Changes During Recrystallization in Silicon Ferrite.** C. G. Dunn. *Metals Technology,* v. 12, April '45, T.P. 1797, 16 pp.

Preparation of specimens and experimental procedure; experimental results; analysis and interpretation of results. 6 ref.

4-19. **A New Microscopy and Its Potentialities.** Charles S. Barrett. *Metals Technology,* v. 12, April '45, T.P. 1865, 50 pp.

A fine-grained photographic plate placed in contact with or very close to the specimen to be examined, and a beam of characteristic X-rays striking the specimen. Images formed on the plate by diffraction can be enlarged to useful magnifications up to 100 or perhaps to 250 diameters. X-ray diffraction micrographs show the places where inhomogeneous strain is concentrated. Sizes and shapes of polycrystalline grains are nicely shown. Cold-worked structure persists throughout the recovery period during annealing. 19 ref.

4-20. **X-Ray Diffraction.** F. G. Firth. *Petroleum Refiner,* v. 24, April '45, pp. 114-120.

Discusses the basic principles of the X-ray. These rays have a wave length "of the same order as the basic repeating structures of matter." Matter is a condition of atomic arrangement. Consequently the X-ray has its place as a tool for examination.

4-21. **Segregation.** *Metal Industry,* v. 66, April 13, '45, pp. 230-231.

Mechanism of solidification; liquid and solid diffusion. 1 ref.

4-22. **Softening of Cold Worked Aluminum.** J. K. Stanley. *Aluminum & Magnesium,* v. 1, April '45, pp. 20-23, 33.

Softening in cold worked aluminum; strain hardening and softening; recovery; recrystallization; grain growth. During the heating of the cold worked aluminum two processes occur. First, the aluminum goes through a recovery period in which most of the internal stresses are relieved and where there is a slight change in hardness. Aluminum can undergo recrystallization by which strain free nuclei grow in the cold worked matrix. The phenomenon results in an isothermal recrystallization curve which is governed by the cooperation of the rate of nucleation and the rate of growth. Large changes in hardness occur during recrystallization. The aluminum after recrystallization on prolonged annealing, particularly at elevated temperatures, undergoes a change in grain size due to grain growth. This growth becomes very aggravated at temperatures above 500° C. especially if the material is pure and long annealing times are used.

4-23. **Mode of Occurrence of Lead in Lead-Bearing Steels and the Mechanism of the Exudation Test.** W. E. Bardgett and R. E. Lismer. Iron & Steel Institute. Advance Copy, March '45, 13 pp.

Extensive examination carried out on high-sulphur and manganese-molybdenum wrought steels and on 0.25% carbon, 1% manganese steel ingots, to find out the mode of occurrence and distribution of lead. Normal methods of microscopic examination failed to reveal the presence of lead as discrete particles, but an electrolytic method revealed particles believed to be lead, not visible in unetched specimens. A new electrographic method is described which produces a clear pattern of the lead or lead-bearing particles in the ingot section.

4-24. **Examination of Two Ingots of Free-Cutting Steel, One Containing Lead and the Other Lead-Free.** C. S. Graham. Iron & Steel Institute. Advance Copy, March '45, 3 pp.

Segregation in an ingot of leaded steel has been compared with that in a non-leaded ingot from the same cast. Little difference in the chemical compositions was found at the Heterogeneity of Steel Ingots Committee's standard positions, with the exception of a small, but possibly significant, reduction in the oxygen content in the lead-bearing ingot. The lead itself was evenly distributed, except at the extreme bottom of the ingot. On the examination of an axial section, the leaded ingot showed less segregation of sulphur and a thinner columnar zone.

4-25. **The Microscopical Examination of Samples of Lead-Bearing and Lead-Free Steels and Ingot Irons.** T. H. Schofield. Iron & Steel Institute. Advance Copy, March '45, 4 pp.

Microscopical examination of samples of lead-bearing steels and ingot irons has revealed small characteristic inclusions which are not present in similar lead-free materials. Using a modified polishing technique, these inclusions appear white, and an etching test indicates that they consist of or contain lead. The inclusions are removed by mercury at 100° C. 9 ref.

4-26. **A Graphic Method for Determining Rates of Solidification.** M. Hampl and V. Vodicka. *Archiv für das Eisenhuttenwesen,* v. 17, Jan.-Feb., '44, pp. 185-191. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 124-A.

A rather complicated equation has been developed by Gröber for calculating solidification rates and the depth to which a substance will solidify in a given time under given conditions. In this paper curves are presented which enable the equation to be solved in a few minutes, and examples are given of their application to determine the freezing rates of water and of liquid steel, as well as the progress of solidification in steel when in contact with a wall of infinite thickness of either cast iron or fireclay.

4-27. **Transformation in Ferrous Alloys.** C. J. Osborn. *Australian Institute of Metals: Australasian Engineer,* v.

44, Dec. 7, '44, pp. 26-29. Iron & Steel Institute *Bulletin*, no. 111, March '45, p. 140-A.

Transformations in ferrous alloys and the effects of different alloying elements explained by reference to equilibrium diagrams and transformation-temperature-time curves. Additions of all alloying elements, except cobalt, retard the decomposition of austenite; this is due partly to the necessity for diffusion of the slower-diffusing alloying element. The only other major effect is that of the carbide-forming elements in increasing the reaction time in the range of about 500° to 600° C. The explanation of this phenomenon is not known, but it is probably related to the stability of the carbides of the alloying elements.

4-28. **An Electron-Diffraction Study of the Atmospheric Oxidation of Aluminum, Magnesium, and Aluminum-Magnesium Alloys.** L. de Brouckere. *Journal* Institute of Metals, v. 71, March '45, pp. 131-147.

Character of films formed on aluminum, magnesium, and aluminum-magnesium alloys has been examined by electron diffraction (a) after standing in air at room temperature, (b) after heating in air at temperatures up to the melting point, and (c) after melting. On abraded aluminum and 8% magnesium-aluminum alloys, the film formed at room temperature is less than 100 A. thick. The film on aluminum which has been melted consists of crystalline gamma Al_2O_3, although rapid heating to 700° C. for short times gives a mixture of the amorphous and gamma-oxides. Aluminum heated at temperatures between 400 and 500° C. for a comparatively long time carries a film of gamma Al_2O_3, but rapid heating to 500° C. for short times causes the formation of an amorphous alumina film. It is suggested that the formation of alumina is determined by the relative speeds of oxidation and crystallization. Magnesium and 35% magnesium-aluminum alloy carry comparatively thick films of magnesia after any treatment. The film is amorphous when formed at room temperatures, but becomes crystalline on heating above 200° C. Aluminum-magnesium alloys containing up to 8% magnesium carry a thick film of MgO after melting, but on heating to temperatures between 120 and 350° C. are covered with crystalline gamma Al_2O_3. Heating above 350° C. causes the formation of a surface film of MgO and progressive heating up to 400° C. causes a duplex film of magnesia superimposed on alumina to form. The black film sometimes formed on these alloys has been shown to consist of magnesia. 27 ref.

4-29. **Micro-Examination of High Silicon Irons.** J. E. Hurst. *Iron Age*, v. 155, May 17, '45, pp. 59-61, 153.

The "barley shell" structure observed in the micro-examination of iron-silicon alloys is the subject of further study. The conclusion is that these strange markings are not the true structure of the alloys or specimens. These structures can also be produced in silicon-free specimens with etching reagents having some silicon content.

4-30. **Recrystallization of Aluminum During Industrial Forming.** K. Kaiser. *Metall Wirtschaft,* v. 22, Nov. 20, '43, pp. 503-507.

4-31. **Gravity and Temperature Liquation in Liquid Two-Component Alloys.** Josef Rief. *Zeitschrift für Metallkunde,* v. 26, Feb. '44, pp. 25-37.

4-32. **Relaxation of Polycrystalline Aluminum and Copper Wire.** George Masing and Ruth Bandler. *Zeitschrift für Metallkunde,* v. 36, May '44, pp. 113-114.

4-33. **X-Ray Determination of Tensile and Compressive Stresses in Brass and in Aluminum-Copper-Magnesium Alloy.** Victor Hauk. *Zeitschrift für Metallkunde,* v. 36, May '44, pp. 120-123.

4-34. **Formation of Martensite in Iron-Nickel-Cobalt Alloys.** K. Schichtel and Ursula Wilke-Dörfurt. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 147-148.

4-35. **Study of Plastic Deformation of Metals. Part II.** James L. Erickson. *Light Metal Age,* v. 3, May '45, pp. 19, 34.

Mechanism of plastic deformation of metallic crystal aggregates discussed.

4-36. **X-Ray Diffraction II.** F. G. Firth. *Petroleum Refiner,* v. 24, May '45, pp. 117-119.

Constitution of matter.

4-37. **Controlling Grain Size in No. 142 Aluminum Alloys.** G. J. Beckwith. *Modern Metals,* v. 1, June '45, pp. 20-21, 23.

Specific methods for controlling grain size in aluminum alloy castings having either thin or heavy sections. Various materials used to insure quality castings such as mold spray, chlorination, metal and casting temperatures, as well as additions of small amounts of alloying ingredients.

4-38. **The Magnetic Properties and the Constitutional Diagram of Iron-Cobalt Alloys.** M. Fallot. *Metaux, Corrosion-Usure,* v. 18, Dec. '43, pp. 214-219. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 157-A.

4-39. **The Variation in the Volume of Alloys in the Heterogeneous Region Liquidus-Solidus. III.** F. Sauerwald. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 543-545.

4-40. **The Solubility of Bismuth in Magnesium.** H. Voss Kuhler. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 545-547.

4-41. **The Solubility of Hydrogen in Zirconium and Zirconium-Oxygen Solid Solutions.** M. N. A. Hall, S. L. H. Martin and A. L. G. Rees. *Transactions of the Faraday Society,* v. 41, June '45, pp. 306-316.

Study of the solubility of hydrogen in zirconium and in zirconium containing oxygen in solid solution to the extent of 50 atom % made isothermally over a range of temperatures up to 1000° C. and at pressures up to 1 atmosphere, rigid precautions being taken for the elimination of surface contamination of the metal by oxide or nitride films.

4-42. **Structural Changes in Carbon and Molybdenum Steels During Prolonged Heating at 900 to 1100° F., as**

Affected by Deoxidation Practice. G. V. Smith, R. F. Miller and C. O. Tarr. American Society for Testing Materials, Preprint 19a, 1945, 18 pp.

Annealed and normalized samples of steels—three with 0.1% carbon, and six with 0.1 to 0.2% carbon and 0.5% molybdenum—of different deoxidation practice were tested at 900, 1000, and 1100° F. for periods up to 5000 hr., and then subjected to hardness tests and to metallographic examination for microstructural changes. 24 ref.

4-43. **Textures, Anisotropy and Earing Behavior of Brass.** F. H. Wilson and R. M. Brick. *Metals Technology,* v. 12, June '45, T.P. 1803, 27 pp.

Survey of the recrystallization textures of brass as affected by annealing temperatures and prior reductions, and an account of the earing behavior which accompanies these textures. Also new data on the anisotropy that accompanies a characteristic texture for brass and endeavors to establish the factors that account for the difference in earing behavior between copper and brass. 13 ref.

4-44. **Internal Friction of Single Crystals of Brass, Copper and Aluminum.** George H. Found. *Metals Technology,* v. 12, June '45, T.P. 1804, 19 pp.

Investigation is concerned with the internal friction of single crystals of aluminum, brass and copper. Further demonstrates the use of damping measurements as a research tool for fundamental metallurgical studies. 14 ref.

4-45. **A Study of Age-Hardening Using the Electron Microscope and Formvar Replicas.** D. Harker and M. J. Murphy. *Metals Technology,* v. 12, June '45, T.P. 1811, 16 pp.

Results obtained on an alloy of 2% beryllium in copper and one of 20% molybdenum in iron described and technique used in preparing the replicas. 6 ref.

4-46. **The Constitution of the Gold-Germanium System.** Robert I. Jaffee, Eugene M. Smith, and Bruce W. Gonser. *Metals Technology,* v. 12, June '45, T.P. 1812, 7 pp.

Composition and melting point of the Au-Ge eutectic reported by Einecke found to be substantially correct. Eutectic composition has been placed at 12.0% germanium. Liquidus curves and the solid solubility of germanium in gold have been determined, and are shown. 5 ref.

4-47. **The Alpha Solid Solution Field of the Copper-Manganese-Zinc System.** R. S. Dean, T. R. Graham and A. H. Roberson. *Metals Technology,* v. 12, June '45, T.P. 1836, 12 pp.

Using high-purity alloys, composition limits of the alpha field of the copper-manganese-zinc system have been determined for temperatures ranging from 800 to 1500° F. at intervals of 100° F. The field is bounded on two sides by the copper-zinc and copper-manganese binary systems, and by the alpha-beta and the alpha plus X fields on the other two sides. The alpha-beta boundary of the field remains approximately parallel

to 60% copper up to 10% manganese and then curves toward the manganese corner with higher manganese contents. 10 ref.

4-48. **The Solubility of Manganese in Liquid Magnesium.** N. Tiner. *Metals Technology,* v. 12, June '45, T. P. 1891, 7 pp.

Investigation to determine accurately the liquid solubility of manganese and its variation with temperature. Solubility of manganese in liquid magnesium is limited and depends on temperature. Alloy additions, such as zinc or aluminum, decrease the solubility of manganese in magnesium. 7 ref.

4-49. **Formation and Structure of Iron Oxide Films.** *Iron Age,* v. 156, July 19, '45, pp. 65, 138.

Use of X-ray reflection to throw light on the formation and crystal structure of iron oxide films reveals that this film is made up of three layers, FeO, Fe_3O_4, and Fe_2O_3. Also discusses the crystal structure of nickel and cobalt oxides. (Translation from Russian *Journal of Technical Physics,* no. 14, 1944, pp. 132-161.)

4-50. **Grain Refinement of a Carbothermic Magnesium Alloy by Superheating.** Ralph Hultgren, David W. Mitchell and Bernard York. *Metals Technology,* v. 12, June '45, T. P. 1853, 8 pp.

Carbothermic ASTM no. 17 magnesium alloy experiences full grain refinement at temperatures as low as 1400° F. (760° C.). When held at 1300 or 1350° F. (704 or 732° C.) the unsuperheated alloy experiences incomplete grain refinement while the superheated alloy coarsens to some extent. Grain size obtained is virtually independent of superheat temperature provided sufficient time of superheating is allowed. 7 ref.

4-51. **Grain Refinement of Magnesium Alloys without Superheating.** Ralph Hultgren and David W. Mitchell. *Metals Technology,* v. 12, June '45, T. P. 1854, 5 pp.

Grain refinement of ASTM alloys nos. 17 and 4 may be obtained without superheating if they are stirred vigorously at 1400° F; electrolytic and carbothermic magnesium alloys both experience full grain refinement on stirring; most of the grain refinement occurs in the first minute of vigorous stirring in small 1-lb. crucibles. 6 ref.

4-52. **Factors Affecting Abnormal Grain Growth in Magnesium Alloy Castings.** A. T. Peters, R. S. Busk and H. E. Elliott. *Metals Technology,* v. 12, June '45, T. P. 1864, 23 pp.

Cast magnesium alloys of certain composition ranges and under certain casting conditions display the unusual property of undergoing local grain growth during heat treatment without the necessity of intentional mechanical stressing. Control methods have been developed for suppressing germination; among these, special heat treating cycles are particularly effective and are in industrial use, but chill coating and intelligent lacing of gates are also helful as additional control measures. Metallographic studies show that

germination occurs during heat treatment by a general recrystallization of the as-cast structure, followed by the early coalescence of grains at a few spots throughout the casting and by growth of the germinant grains so formed. 14 ref.

4-53. **A Study of Factors Influencing Grain Size in Magnesium Alloys and a Carbon Inoculation Method for Grain Refinement.** C. H. Mahoney, A. L. Tarr and P. E. LeGrand. *Metals Technology,* v. 12, June '45, T. P. 1892, 20 pp.

Experiments to determine a procedure for grain size control of magnesium alloys, including the Elektron A5 and A8 type alloys. Grain size control can be obtained by carbon inoculation at considerably lower temperatures than is required for ordinary superheating practice. 11 ref.

4-54. **Metallographic Identification of Ferromagnetic Phases.** E. A. M. Harvey. *Metallurgia,* v. 32, June '45, pp. 71-72.

"Magnetic etchings" method for the metallographic identification of ferro-magnetic phases is perhaps not so widely known as it deserves to be. This brief description of the method and apparatus used is given so that those workers not familiar with the detailed procedure may have available working details of the simple apparatus required.

4-55. **A New Method of Evaluating Grain Size.** William A. Johnson. *Steel,* v. 117, Aug. 20, '45, pp. 128-131, 168, 170, 172, 174.

Logarithmic relationship between dimensions of grain and grain size number aids calculation in new system for determining spatial grain size of equiaxed polycrystalline metals. Distribution of sizes shown to be all-important. 2 ref.

4-56. **The Liquidus-Solidus Temperatures and Emissivities of Some Commercial Heat Resistant Alloys.** James T. Gow, Anton De S. Brasunas, and Oscar E. Harder. *Metals Technology,* v. 12, Aug. '45, T.P. 1838, 18 pp.

Results obtained and the techniques employed in determining liquidus and solidus temperatures of the HH and HT type heat resistant alloys. The relation of true temperatures (thermocouple) to apparent temperatures (optical pyrometer) for the molten HH and HT type alloys. 6 ref.

4-57. **Effect of Variables on the Recrystallization of Silicon Ferrite in Terms of Rates of Nucleation and Growth.** James K. Stanley. *Metals Technology,* v. 12, Aug. '45, T.P. 1840, 23 pp.

Data presented on the effect of deformation on the recrystallization of 1% silicon ferrite. Effect of temperature was studied at 740, 770, and 800° C. on the isothermal recrystallization curves. Fine-grained material recrystallizes more rapidly than coarse-grained material. Addition of a solid-solution element like silicon to iron decreases the rate of recrystallization. Recovery of cold worked 1% silicon ferrite for 25 hr. at 350° C. results in a very slight increase in the rate of recrystallization. 14 ref.

4-58. **Metallography in Color.** R. P. Loveland. *Metal Industry,* v. 67, Aug. 10, '45, pp. 82-85, 87.

Color effects have long been used by metallographers for the identification of inclusions, segregate phases and diffusion zones; later developments in the application and use of polarized light greatly enlarged the scope of these identification methods. (From A.S.T.M. *Bulletin.*)

4-59. **The Sigma Phase.** Francis B. Foley. *Alloy Casting Bulletin,* No. 5, July '45, pp. 1-9.

An important property of alloys utilized for heat resistant service is the ability of the metal to retain its desirable characteristics throughout the range of probable operating temperatures. Some high alloy ferrous metals are subject to embrittlement at certain elevated temperatures as a result of the formation of a constituent called the "sigma phase." If appreciable amounts of the extremely hard, brittle sigma phase can be formed, an alloy steel may lose ductility to such an extent that its usefulness may be seriously impaired. Although the existence of this phase has been observed for a number of years, the possibility of the occurrence of phases other than the well-known alpha and gamma may sometimes be overlooked in the consideration of alloys suitable for high temperature applications. Nature and occurrence of the sigma phase.

4-60. **Metallography in Color.** R. P. Loveland. *Metal Industry,* v. 67, Aug. 17, '45, pp. 98-100.

The illumination system and the compensation necessary to make up for its shortcomings.

4-61. **Metallography in Color.** R. P. Loveland. *Metal Industry,* v. 67, Aug. 24, '45, pp. 119-120.

Correct exposure, as in all photographic processes, is of paramount importance in color photomicrography. Suggests the best method of obtaining this. Typical photomicrographs reproduced in color illustrate the results that can be obtained when the correct procedure is followed. 12 ref.

4-62. **Some Applications of X-Ray Diffraction.** Stanley Brosky. *Industrial Radiography,* v. 4, summer '45, pp. 42-46.

Powder method of crystal examination; Bragg's law and interplanar spacings.

4-63. **Trends in Metallurgy.** Gustav W. Pirk. *Wire & Wire Products,* v. 20, Oct. '45, pp. 758-761, 764-765, 768-770, 797.

Emphasizes increasing need for a more thorough understanding of fundamental scientific principles as applied to general problems without getting theoretical. Physical metallurgy is the common ground on which factory and laboratory should work out the problems of production.

4-64. **Constitution of Mild-Steel Arc-Weld Deposits.** H. A. Sloman, T. E. Rooney and T. H. Schofield. *Engineering,* v. 160, Aug. 31, '45, p. 197.

Investigation into the hydrogen content of weld metal to ascertain its origin and to make possible a control of the conditions, as far as hydrogen is concerned, under which weld metal is deposited. (From Institute of Metals.)

4-65. **The Technique of Macrography.** *Chemical Age,* v. 53, Sept. 1, '45, pp. 195-197.

Preparation of specimen by macro-etching.

4-66. **The Structure of Electrodeposited Copper-Zinc Alloys.** *Monthly Review,* v. 32, Sept. '45, pp. 880-886, 938.

Structures of the deposits over the whole range of copper-zinc alloys compared with the phase diagram for these alloys. Some information on the relationship between the properties of electrolytic and recrystallized alloys was obtained. 6 ref. (Prepared from a paper by E. Raub and D. Krause, *Zeitschrift für Elektrochemie,* v. 50, 1944, p. 91.)

4-67. **Constitution of Mild Steel Arc-Weld Deposits.** H. A. Sloman, T. E. Rooney and T. H. Schofield. *Engineering,* v. 160, Sept. 14, '45, pp. 217-220.

Determination of the hydrogen in weld metal; metallographic examination of welds. (From Institute of Metals.)

4-68. **Metallography of Alcoa 75S Alloy.** F. Keller. *Iron Age,* v. 156, Oct. 4, '45, pp. 64-68.

Use of zinc, magnesium and copper as major alloying elements in this high strength aluminum constructional alloy produces somewhat different microstructural characteristics than in other aluminum alloys. Etches and procedures for studying the microstructure of 75S, as well as a discussion of the more important microstructural features are given.

4-69. **Thermal Analysis.** *Metal Industry,* v. 67, Sept. 14, '45, pp. 169, 172.

Interpretation of cooling curves. 3 ref.

4-70. **Age Hardening of the Solid Solution Aluminum-Zinc.** J. Herenguel and G. Chaudron. *Revue de Metallurgie,* v. 41, no. 2, Feb. '44, pp. 33-41. *Engineers' Digest* (American Edition), v. 2, Sept. '45, pp. 446-448.

Study of solid solutions of aluminum-zinc made up from metals of very high purity. It was found that in this case age hardening takes place to a very considerable degree. An examination was also made of the effects of small additions of magnesium, iron and silicon to the high-purity alloy.

4-71. **The Constitution of the Aluminum-Rich Aluminum-Chromium Alloys.** G. V. Raynor and K. Little. Institute of Metals *Journal,* v. 71, Sept. '45, pp. 481-489.

Solid solubility curve for chromium in aluminum redetermined between the peritectic temperature and 350° C., using micrographic methods. Results are in good agreement with those which Koch and Winterhager obtained by X-ray methods, and with the micrographic results of Fink and Freche above 530° C. Composition of the phase which enters into equilibrium with the primary solid solution has been accurately established. It corresponds to the formula $CrAl_7$. 12 ref.

4-72. **Constitution of Mild Steel Arc Weld Deposits.** H. A. Sloman, T. E. Rooney and T. H. Schofield. *Engineering,* v. 160, Sept. 21, '45, pp. 238-240.

Constituents varied with the carbon and nitrogen contents and did not resemble lamellar pearlite in any of the deposits. Etching medium used for all the photomicrographs was a solution of nitric acid in alcohol. Shows the structure after heating at 940° C. for 15 min., followed by 26 days at 200° C. (Paper for Iron and Steel Institute.)

4-73. **Influence of Carbon Content Upon the Transformations in 3% Chromium Steel.** By Taylor Lyman and Alexander R. Troiano. American Society for Metals Preprint 16, 1945, 44 pp.

Transformations in seven 3% chromium steels with carbon contents of 0.08 to 1.28% have been investigated as functions of time and temperature using microscope, dilatometer and X-ray diffraction. Isothermal transformation diagrams for these steels are presented. Each of the seven steels can contain both $(Fe, Cr)_3C$ and $(Cr, Fe)_7C_3$ after certain isothermal treatments although only the 0.89% carbon steel contains both carbide phases following treatments designed to produce equilibrium at high sub-critical temperatures. The previous structure has a marked influence upon the rate of formation of $(Cr, Fe)_7C_3$ from alpha plus $(Fe, Cr)_3C$. 16 ref.

4-74. **Critical Points of S.A.E. 4340 Steel as Determined by the Dilatometric Method.** D. Niconoff. American Society for Metals Preprint 19, 1945, 18 pp.

As determined by the dilatometric method, the position of the critical points observed on heating S.A.E. 4340 steel depends upon the prior structure of the steel as well as upon the heating rate employed. Corresponding critical temperatures obtained on cooling are affected by the time and temperature of soaking preceding the cooling operation, but even more so by the variation in cooling rates. 4 ref.

4-75. **High Forging Temperatures Revealed by Facets in Fracture Tests.** J. Robert Strohm and W. E. Jominy. American Society for Metals Preprint 25, 1945, 16 pp.

Appearance of large grains or facets in the fracture of alloy steel forgings is an indication of questionable quality and of high temperature forging. Temperatures below which facets are not formed were accurately determined by means of thermocouples inserted in test pieces and by fracture testing production forgings. Facets appear in fractures of quenched and tempered forgings and not in normalized or annealed forgings. The tensile properties of bars containing facets are found to be less favorable than those which have no facets.

4-76. **Relationship Between the Deep Drawing Properties of Autobody Sheet, Its Austenitic Grain Size and McQuaid-Ehn Carburizing Characteristics.** K. J. B. Wolfe. American Society for Metals Preprint 27, 1945, 17 pp.

Carburizing tests carried out on sample batches which consistently gave good and bad results on similar pressings, in order to determine the austenitic grain size and the McQuaid-Ehn characteristics of samples. It has been shown that sheets having good pressing properties possess a small austenitic grain size associated with an "ab-

normal" microstructure. On the other hand, sheets which have inferior pressing properties show a large austenitic grain size associated with a "normal" McQuaid-Ehn characteristic. Theory has been postulated to explain these results. 8 ref.

4-77. **The Nucleus of the Atom, Part XXI.** Samuel Glasstone. *Monthly Review,* v. 32, Oct. '45, pp. 999-1000, 1050.

Positive charges on the nucleus; increasing complexity of atomic structure; structure of the nucleus; the neutron in nuclear structure; isotopes.

4-78. **Lamellar and Mosaic Structures—X-Ray and Thermodynamic Evidence.** Helmut Thielsch. *Metals Technology,* v. 12, Oct. '45, T.P. 1931, 6 pp.

Reviews the most important of the results obtained by other investigators, especially in Germany, where a great deal of attention has been given to mosaic structure during the last three years. 54 ref.

4-79. **Partition of Molybdenum in Hypo-Eutectoid Iron-Carbon-Molybdenum Alloys.** Fred E. Bowman. American Society for Metals Preprint 2, 1945, 16 pp.

Partition of molybdenum between the ferrite and carbide resulting from the isothermal transformation of austenite as well as from tempering martensite is extended to hypo-eutectoid alloys of iron, carbon, and molybdenum. High molybdenum concentration in the carbides formed isothermally and subcritically from austenite proves that molybdenum must diffuse during the eutectoid reaction. 10 ref.

4-80. **Magnesium Alloys.** *Metal Industry,* v. 67, Oct. 26, '45, pp. 265, 268.

Theory of superheating and grain refinement. 3 ref.

4-81. **The Absorption Displacement in X-Ray Diffraction by Cylindrical Samples.** B. E. Warren. *Journal of Applied Physics,* v. 16, Oct. '45, pp. 614-620.

In precision determination of lattice constants from back reflection Debye-Scherer patterns, one of systematic errors arises from effect of absorption in the sample. Magnitude and form of this error is calculated here for a cylindrical sample, for both parallel and diverging primary beams, and for a representative variety of values of the absorption coefficient.

4-82. **A Thermodynamic Study of the Tin-Antimony System.** Rudolph O. Frantik and Hugh J. McDonald. Electrochemical Society, Preprint 88-21, 1945, 9 pp.

Activities, relative partial molal and total relative heat contents, free energy changes and entropies evaluated for both components and for the system over complete concentration range at 905.1° K. Shown that solutions of tin-antimony at 905.1° K exhibit Hildebrand "regular" solution behavior.

4-83. **A Thermodynamic Study of the Tin-Silver System.** R. O. Frantik and H. J. McDonald. Electrochemical Society, Preprint 88-22, 1945, 8 pp.

Thermodynamic data determined by electromotive force measurements on concentration cells involving pure tin

and alloys of tin and silver. Activities, relative partial molal and total relative heat contents, free energy changes and entropies evaluated for both components and for the system over complete concentration range at 900.1° K. Shown that solutions of tin-silver are not "regular" solutions and that behavior of these alloys is similar to behavior of liquid zinc-antimony alloys.

4-84. **Examination of Four Samples of Early Aluminum Alloy Sheet Metal.** K. J. B. Wolfe. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1943-1950, 1958.

Four samples of early aluminum alloys examined. General conclusions drawn about the control of melting and casting conditions at the times these alloys were produced, and comments made on the significance of the susceptibility of duralumin-type alloys to intercrystalline corrosion in the framework of an airship.

4-85. **"Patterning" of Aluminum Sheet.** N. W. Beliaeff. *Metal Industry,* v. 67, Nov. 2, '45, pp. 278-279.

Method of determining cause of "patterning" in aluminum sheet described showing the various tests carried out including macro and micrographic observations. (From *Metaux.*) 12 ref.

SECTION V

POWDER METALLURGY

5-1. **Some Aspects of Powder Metallurgy.** Earle E. Schumacher and Alexander G. Souden. *Bell System Technical Journal,* v. 23, Oct. '44, pp. 422-457.

More common aspects of the powder metallurgy process to acquaint telephone engineers with an increasingly important production method, and to provide an outline of topic references that could otherwise be obtained only from many different sources. 67 ref.

5-2. **Iron in Powder Metallurgy.** R. J. Traill. *Canadian Mining & Metallurgical Bulletin,* no. 392, Dec. '44, pp. 490-500.

Present methods, employing cold pressing and sintering, produce parts that are comparatively poor in mechanical strength. Much hope lies in the successful development of hot pressing methods, whereby mechanical strength can be greatly improved. Aside from desirable physical properties, the iron powder of the future will need to be of high quality and low cost.

5-3. **Powdered Metallurgy.** A. J. Langhammer. *Refrigerating Engineering,* v. 49, Jan. '45, pp. 26-27, 41, 55.

Future possibilities of the art are wide in scope. Manufacture of Oilite self-lubricating bronze bearings from thoroughly mixed metal powders. Economies in time, labor and cost in the manufacture of war materials cited. Significant data on powder metallurgy included in discussion by John Sasso.

5-4. **Powder Metallurgy.** W. I. Pumphrey. *Automobile Engineer,* v. 34, Dec. '44, pp. 547-548.

Some applications of the process in the automobile industry. 3 ref.

5-5. **Physical Properties of Brass Powders.** *Iron Age,* v. 155, Jan. 25, '45, pp. 60-62.

Advantageous properties of brass powder compacts have been overshadowed by the little available knowledge of proper sintering atmospheres. Results on the sintering of 70-30 and 90-10 brass powders indicate that under proper sintering conditions excellent physical properties are obtainable.

5-6. **Symposium on Production and Design Limitations and Possibilities for Powder Metallurgy Parts.** *Metals Technology,* v. 12, Jan. '45, T. P. 1788, 96 pp.

Foreword, by F. N. Rhines. What Can Be Accomplished With the Metal Forms That Compete With Powder Metallurgy Parts? by Fred P. Peters. Machine Parts by Powder Metallurgy, by A. J. Langhammer. Pole Pieces for Electric Motors From Iron Powder, by F. V. Lenel. Bearings From Metal Powders, by W. R. Toeplitz. Brushes and Allied Powder Metallurgy Parts, by R. R. Hoffman. Electrical Contacts and Related Products, by E. I. Larsen. Sintered Magnets, by C. R. Fulton. Friction Articles From Metal Powders, by C. T. Cox. Certain Characteristics of Silver-Base Powder Metallurgical Products, by F. R. Hensel and E. I. Larsen. Some Properties of Sintered and Hot-Pressed Copper-Tin Compacts, by C. G. Goetzel. Studies Upon the Sintering of Metal Powders—Copper (Abstract), by C. J. Bier and J. F. O'Keefe. Some Experiments on the Effect of Pressure on Metal Powder Compacts, by Jerome F. Kuzmick. With discussion.

5-7. **The Fused Salt Electrolysis for the Production of Metal Powders.** W. J. Kroll. Electrochemical Society Preprint 87-5, April 16, '45, 18 pp.

Production of relatively pure metal powders or metal-alloy powders by the fused electrolyte method. Three major metal products of the fused electrolyte industry are sodium, aluminum, and magnesium. In each case the temperature of the fused salt bath is decidedly above the melting point of the metal produced. Advantage of operating at lower bath temperatures and of getting a solid rather than a liquid product is offset by the difficulty in eliminating the entrained or adherent fused salt from the metal crystals. Examples cited to illustrate the fundamental reactions taking place at the cathode and at the anode when solid metals or alloys are being deposited from a fused salt bath. 60 ref.

5-8. **Powder Metallurgy. B. Applications, Uses and Trends.** J. H. Robinson. Australian Institute of Metals: *Australasian Engineer Science Sheet,* Sept. 7, '44, pp. 5-7. Iron and Steel Institute *Bulletin* no. 109, Jan. '45, p. 74-A.

The advantages of applying powder metallurgy to the manufacture of a wide variety of articles are outlined.

5-9. **Powder Metallurgy. A. Manufacturing Methods and Limitations.** J. H. Bull. Australian Institute of Metals: *Australasian Engineer Science Sheet,* Sept. 7, 44, pp. 2-4. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 74-A

Methods of manufacturing parts by powder metallurgy described. In some instances the pressing, sintering and sizing are done in separate operations each requiring its special plant, but in others such as making cemented carbide forming dies, the three operations can be combined by hot pressing the preheated powder.

5-10. **New Method of Tipping Tools.** *Western Metals,* v. 3, Feb. '45, p. 16.

Two outstanding silver-copper and one copper alloy used for tipping tungsten carbide and high speed steel tools now available in a fine powder, the product of the Eutectic Welding Alloys Co.

5-11. **Large Carbide Parts Formed by Hot Pressing.** *Western Metals,* v. 3, Feb. '45, p. 54.

Electric resistance heating employed. Development of a "hot press" method which incorporates in one single operation the three distinct processes of pressing, semi-sintering, and sintering.

5-12. **Preparation of Copper Powder by Electrodeposition.** A. W. Hothersall and G. E. Gardam. *Journal of Electrodepositors' Technical Society,* Preprint, v. 20, 1945, pp. 61-68.

Conclusions of a laboratory investigation carried out in 1934 for the British Non-Ferrous Metals Research Association. Object was to determine the most suitable and simplest conditions for the production of copper powder on a pilot plant scale. An outline design for a pilot plant to prepare 1 lb. of powder per hr. is included. No account has been taken of the patent situation.

5-13. **Powdered Metal Points the Way to Machine-Building Economies.** A. J. Langhammer. *Machinery,* v. 51, April '45, pp. 152-161.

Art of compressing and sintering metal powders into bearings and machine parts has been developed to such an extent that products weighing as much as 100 lb. can be economically made by this process.

5-14. **Clutch Facings and Brake Linings of Powdered Metal Type.** Joseph Geschelin. *Automotive Industries,* v. 92, April 1, '45, pp. 24-26, 85-86.

Among the unique advantages of all-metal friction linings, according to the manufacturer, are the following: Satisfactory performance at temperatures and unit pressures greatly exceeding those of conventional materials; longer life under severe operating conditions; the effect of oil and water on clutch and brake action minimized; it withstands severe shock loads; little affected by extremes of temperature or by variations in atmospheric humidity; can usually be used to replace conventional linings without changes in existing designs.

5-15. **Powder Metal Parts.** G. W. Birdsall. *Steel,* v. 116, April 16, '45, pp. 106-109, 150, 153-154, 156, 158.

Become more useful due to increased physical properties made possible through development of better methods of powder manufacture and control, and greater knowledge of processing accumulated in supplying wartime demands. Size and strength limitations prove unfounded.

5-16. **Metal-Powder Friction Materials.** Clyde S. Batchelor. *Metals & Alloys,* v. 21, April '45, pp. 991-993.

Sintered metallic friction materials in forms and sizes once considered impossible are today serving ruggedly in brake linings, clutch rings and faces, automatic transmission plates, etc. Characteristics, present uses and future prospects of these important powder metallurgy products. (Originally presented at the Cleveland meeting of the Metal Powder Association.)

5-17. **Iron in Powder Metallurgy.** R. J. Traill. Canadian Institute of Mining and Metallurgy *Transactions,* v. 47, Dec. '44, pp. 490-500. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 122-A.

The economic aspects of iron powder metallurgy are reviewed. The advantages and disadvantages of using powders prepared from electrolytic iron, and by the gaseous reduction of iron oxide and from mill scale, are discussed. The results of tests on bars containing 0.5% of carbon, all pressed at 60,000 psi., indicate that those made from electrolytic iron have greater tensile strength, elongation and density than those made from hydrogen-reduced iron.

5-18. **The Relationship Between the Production of Iron Powders and the Properties of Powder Metallurgy Products.** W. Dawihl and U. Schmidt. *Stahl und Eisen,* v. 65, Jan. 4, '45, pp. 9-14. Iron and Steel Institute *Bulletin,* no. 111, March '45, pp. 121-A-122-A.

The results of investigations of the porosity, strength, and other properties of powder metallurgy products made of iron powders produced by several different processes are discussed and compared. The porosity and structure were examined by micrographs at high magnification, and microhardness tests were made. The effects of the manufacturing process are still quite marked, even after sintering at 1450° C. The pores in parts made from powders of iron that has been melted are uniformly distributed, while the distribution is not uniform if the iron has not been melted (e.g., powder from sponge iron). If the powder has been subjected to severe deformation (e.g., when made by the cold-stamping of sheet iron) this has a detrimental effect on the sintering properties and on the growth of the ferrite. The microhardness readings indicated that the uniting of the crystals gave rise to additional stresses called sintering stresses; these stresses were probably the cause of the change in microhardness with the method of producing the powder. Additional time and power consumption in making the powder can in some cases be compensated by simplification in the finishing processes; for instance, when a compact is made from a powder produced by directing two streams of particles one against the other, sintering only is required to produce a soft and easily deformed part, whereas, with powders made by other methods, forging and recrystallization are necessary to produce the same deformability.

5-19. **Copper Powder.** A. W. Hothersall and G. E. Gardam. *Metal Industry,* v. 66, April 13, '45, pp. 234-236.

Commercial preparation by electrodeposition. Determines the most suitable conditions for the production of copper powder on a pilot plant scale. (Electrodepositors' Technical Society.)

5-20. **Particle Size Analysis of Iron Powders in Powder Metallurgy.** Harold H. Steinour. *Iron Age,* v. 155, May 17, '45, pp. 65-71.

Comparisons of the particle size analysis of five com-

mercial iron powders obtained by the Wagner turbidimeter method, originally developed for portland cement analyses, show close agreement in four out of five cases with computed recombinations of the fractions. Specific surface values obtained by the air permeability method reported for the five commercial powders and some others. A sixth commercial iron powder composed of spherical particles tested and gave a value consistent with microscopic measurements reported by the manufacturer.

5-21. **Metal Powders.** *Steel*, v. 116, May 28, '45, p. 114.
Produced by fused salt electrolysis for powder-metal compacts. About 20 different metals have been deposited as small crystals or dendrites by this method.

5-22. **Copper and Copper-Base Alloys.** J. W. Donaldson. *Metal Industry*, v. 66, May 4, '45, pp. 281-282.
Deals with the preparation of copper and its alloys by powder metallurgy processes. Brief reference is also made to the machinability of copper alloys and to modern methods of welding these materials. A review of American investigations and researches during 1944. 12 ref.

5-23. **A Rapid Optical Method for Estimating the Specific Surface of Powders.** E. Sharratt, E. H. S. Van Someren and E. C. Rollason. Society of Chemical Industry *Journal*, v. 64, March '45, pp. 73-75.
Estimating surface areas from an observation of the optical density of their dilute suspensions. Gives satisfactory results directly with opaque powders lying within the 2.5-150μ range principally. Transparent powders give low results, but the method is of some value as a means of comparison.

5-24. **Powdered Iron Cores.** C. T. Martowicz. *Electronic Industries*, v. 4, June '45, pp. 108-110.
Design factors that influence realization of the superior electrical characteristics of iron cored coils.

5-25. **Sintered Metals.** R. Kieffer and W. Hotop. *Metal Industry*, v. 66, June 1, '45, pp. 342-344.
It is frequently thought that it is only necessary to apply sufficient pressure to a metal powder to produce a metal equivalent in properties to a fused product. That this is not so is shown. Properties of the finished sinters. (Translated from *Kolloid Zeitschrift*, Aug.-Sept. '43.) 11 ref.

5-26. **Sintered Metals.** R. Kieffer and W. Hotop. *Metal Industry*, v. 66, June 8, '45, pp. 354-356.
Comparison of properties with equivalent fused materials. 7 ref.

5-27. **Effects of Pressure and Temperature on Iron Powder Compacts.** Charles O. Heath, Jr. and Joseph D. Stetkewicz. *Metal Progress*, v. 48, July '45, pp. 73-76.
Procedure consists of pressing a measured quantity of iron powder in a die under pressure up to 50 or 60 tons per sq. in. Green compact formed has a highly polished surface and considerable surface hardness, but lacks the strength necessary for use as a finished

piece, so it is fired in a furnace with a neutral or reducing atmosphere. This temperature promotes sintering of the particles at contacting areas and results in greater strength, density, and toughness.

5-28. **The Explosibility of Metal-Powder Dust Clouds.** Irving Hartmann and H. P. Greenwald. *Mining & Metallurgy,* v. 26, July '45, pp. 331-335.

Many metal dusts offer dangerous but little-known hazards. Safety measures recommended.

5-29. **Powdered Metals Have Wide Application.** *Petroleum World,* v. 42, June '45, pp. 49-51.

Porosity, strength and self-lubrication are the highly useful combination of qualities that are built into powdered metals.

5-30. **Powder Metallurgy Affords Various Advantages.** Raymond B. Aufmuth. *SAE Journal,* v. 53, July '45, pp. 44-45.

Methods of production and advantages of metal powders.

5-31. **Hard Cutting Tools and Their Sharpening.** *Le Genie Civil,* no. 3104, v. 120, no. 5, March 1, '43, *Engineer's Digest* (American Edition), v. 2, June '45, pp. 270-273.

Chromium, carbon, molybdenum, nickel, vanadium, boron, and even particles of diamond, enter into the making of the cutting tips now used. Choice and proportions of these numerous constituents vary according to the qualities of endurance, hardness, resistance or toughness of cut required. Preparation involves successive transformations beginning with the carbide powders and fusible metals.

5-32. **Sintered Beryllium for X-ray Tube Windows.** Floyd C. Kelley. *Iron Age,* v. 156, July 26, '45, pp. 68-69.

Process of pressing and sintering coarse beryllium powder without the use of any grain refining elements, such as titanium, for producing an X-ray window which is less susceptible to cracking due to thermal stresses encountered in brazing.

5-33. **Magnetic Powders.** H. Gregory Shea. *Electronic Industries,* v. 4, Aug. '45, pp. 86-89, 186, 190, 194, 198, 202.

Many physical and chemical characteristics bear on the usefulness of metallic and compound iron powders.

5-34. **Postwar Horizons for Powder Metals.** P. Schwarzkopf and A. Reis. *American Machinist,* v. 89, Aug. 2, '45, pp. 99-103.

Present possibilities and limitations of the art. Small machine parts, especially those difficult to machine or requiring peculiar properties, are being manufactured at costs which compare favorably with better known methods.

5-35. **Miracle or Mirage.** Fred P. Peters. *Scientific American,* v. 173, Aug. '45, pp. 99-101.

Powder metallurgy, an older art than many realize, can thank the automotive industries for much of its recent expansion. Will this growth continue or will the modern miracle prove to be a mirage?

5-36. **Machine Parts and Bearings Fabricated From Powdered Metals.** George E. Platzer. *Tool Engineer,* v. 14, July '45, pp. 36-39.

Less machining, closer limits, release of critical machine tools and lower production costs are among advantages of modern powder metallurgy.

5-37. **Metal Powders.** *Metal Industry,* v. 67, July 27, '45, pp. 53, 55.

Metal powders are usually made by electro-deposition (copper), by reduction of oxides (tungsten, molybdenum, and sometimes nickel, iron and cobalt), by atomizing (lead and tin), or by decomposition of the carbonyls (iron and nickel). 3 ref.

5-38. **"Diecarb" Blanking and Forming Dies.** *Tool & Die Journal,* v. 11, Aug. '45, pp. 112-114.

Sintered carbide blanking and forming dies make use of inserts of Diecarb, sintered carbide combinations with Rockwell hardnesses of from 65 to 73. Life, versatility and application of Diecarb.

5-39. **Processing Techniques Affect Design of Powder Metal Parts.** P. Schwarzkopf. *American Machinist,* v. 89, Aug. 16, '45, pp. 118-121.

Clever tool design accomplishes much toward realizing intricate shapes, but for every part one must remember the peculiarities of compacting and sintering.

5-40. **Notes on Copper-Base Compacts and Certain Compositions Susceptible to Precipitation Hardening.** F. R. Hensel, E. I. Larsen and E. F. Swazy. *Metals Technology,* v. 12, Aug. '45, T.P. 1810, 12 pp.

Copper compacts were studied and a preliminary investigation indicates that excellent physical and electrical properties can be obtained with age hardening compositions containing chromium, cobalt, and beryllium, or nickel and beryllium. The addition of small percentages of phosphorus and titanium hydride is beneficial in such alloys. 3 ref.

5-41. **German Cemented Carbide Industry.** Gregory Comstock. *Iron Age,* v. 156, Aug. 30, '45, pp. 36A-36L.

Description of the wartime controls set up in Germany, the standardization of carbide types for particular applications, production data, information on new production techniques, a report on a new titanium carbide, vanadium carbide, and an investigation of advances in hot pressing practices.

5-42. **Powder Metallurgy.** *Metal Industry,* v. 67, Aug. 31, '45, p. 137.

Production; design limitations; possibilities. 1 ref.

5-43. **Powder Metallurgy.** G. H. S. Price. Electrodepositors' Technical Society *Journal,* (Preprint) v. 20, 1945, pp. 147-153.

Brief, general review of the subject of powder metallurgy with particular reference to the types and properties of the powders used.

5-44. **Metal Powders.** *Automobile Engineer,* v. 35, Sept. '45, p. 353.

Production methods and their advantages.

5-45. **Powder Metallurgy.** *Automobile Engineer,* v. 35, Sept. '45, p. 368.

Modern applications of an important technique. Cemented carbides; porous bearings; sintered iron parts; metallic friction materials.

5-46. **Alloy Welding Wire From Powder Metallurgy.** F. G. Daveler and P. H. Aspen. *Welding Journal,* v. 24, Sept. '45, pp. 842-844.

Alloy welding rod; synthetic rod production; early research; sintering; flux coatings; costs; future enterprise.

5-47. **Crystalline Titanium Nitride.** V. P. Remin Ufan. *Metallurgia,* v. 32, Aug. '45, pp. 160-162.

Production of crystalline titanium nitride by melting powdered material. Because of its hardness and resistance to wear, it may be used for some purposes in industry as a substitute for diamond. (*Vestnik Metalloprom.,* 1938, pp. 54-62.)

5-48. **Plastics Increase Powder-Metal Flow.** Harry L. Strauss, Jr. *American Machinist,* v. 89, Sept. 27, '45, p. 113.

Limitations upon part shape reduced by using a plastic as a liquid vehicle and then burning it off before final compacting.

5-49. **Powder Metal Machine Parts.** *Machine Design,* v. 17, Oct. '45, pp. 133-136.

Emphasizes custom-made parts—those produced to the customer's specifications—and points out the disadvantages offered by powder metals in such applications.

5-50. **Powder Metallurgy Precision Parts.** R. Hradecky and Richard P. Seelig. *Iron Age,* v. 156, Sept. 27, '45, pp. 50-54, 132.

Explores the postwar possibilities of new techniques, new products and new powder alloys and mixtures. Since one of the most fertile fields for this process is that of magnetic parts, a new sintered iron has been developed. This material is described and its coercive force and maximum permeability plotted.

5-51. **Tungsten Carbide Machine Parts.** S. H. Brams. *Iron Age,* v. 156, Sept. 27, '45, pp. 55-57.

Increase in manufacturing facilities and the concomitant reduction in price make possible the application of tungsten carbide as a metal for fabrication in addition to its former use as a cutting tool. Experiments have proved that tungsten carbide can be successfully used for machine parts subject to considerable wear. Results of such trials at the Carboloy Co. plant are reported and new uses for the material suggested.

5-52. **Sintered Carbide Die Insert.** *Steel,* v. 117, Oct. 22, '45, pp. 111, 126.

Multiplies by 10 to 1000 the number of pieces produced per grind.

5-53. **Boron Carbide—Hardest Man-Made Material.** Edwin Laird Cady. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1058-1063.

Advantages and disadvantages; boron carbide vs. diamond dust; solid parts with fine finish; fabrication methods; fastening and assembly practice; applications—gages and parts; blast nozzles and other uses.

5-54. **Metal Powders.** W. J. Kroll. *Metal Industry,* v. 67, Oct. 5, '45, pp. 214-216.

Production of relatively pure metal powders or metal alloy powders by the fused electrolyte method. Methods for removing adherent bath salts from the metal crystals are dealt with and numerous examples given. (Paper presented before the Electrochemical Society.)

5-55. **Radio Frequency Cores of High Permeability.** Hans Beller and G. O. Altmann. *Electronic Industries,* v. 4, Nov. '45, pp. 86-89, 152, 154.

Cores made from a special grade of carbonyl iron powder to meet the demand for powdered magnetic cores combining both high permeability and low losses at frequencies up to several megacycles.

5-56. **Hot-Pressing of Iron Powders.** Otto H. Henry and J. J. Cordiano. *Metals Technology,* v. 12, Oct. '45, T.P. 1919, 10 pp.

Properties that can be obtained on hot-pressed iron powders are far superior to the properties of cold-pressed and sintered iron powders. However, the time, temperature and pressure requirements are too severe for present-day commercial equipment. With advances in processing and materials, the hot-pressing of metal powders should take its place as an important method of fabricating metal.

5-57. **Pressing Complicated Shapes From Iron Powders.** Claus G. Goetzel. *Metals Technology,* v. 12, Oct. '45, T.P. 1920, 13 pp.

Two processes for molding uniformly dense parts with complicated shapes from powdered metals described in detail. First refers to curved parts; the second is especially adapted to parts having one or more recesses or steps. Both methods are applied under the condition that presents the more difficult problem. Variable factors in molding powdered metal parts reviewed. Idealized procedure considered briefly.

5-58. **Sectional Carbide Molds Facilitate Recutting.** *Iron Age,* v. 156, Oct. 25, '45, pp. 50-51.

Major advantage of the sectional as opposed to the solid nib is the fact that the nib may be recut and that the life of the mold is limited only by the amount of stock which is removed. Recutting to the original size is advantageous for both standard shapes and special shapes that call for long production runs, because worn molds are reclaimable. In addition to being recut to original size a sectional nib mold also may be recut to larger size within the limits of the nib diameter.

5-59. **Powder Metallurgy Production of Machine Parts.** *Machinery* (London), v. 67, Sept. 27, '45, pp. 337-343.

During the course of a twelve-month, more than 5,000,000 man-hours and 1,250,000 lb. of critical metals were saved in making gun parts from powdered metal. Approximately 2 hr. was required to machine the gun part when it was a forging. Now it is being made from powder in 22 sec., not including the heat treatment. Powdered metal part requires no machining, except for drilling a small hole.

5-60. **Sintered Iron.** *Automobile Engineer,* v. 35, Oct. '45, p. 400.

Its carrying capacity when used for bearing liners.

5-61. **Metal Powders.** W. J. Kroll. *Metal Industry,* v. 67, Oct. 12, '45, pp. 229-230.

Gives practical examples of fused salt electrolysis with insoluble and with soluble anodes, and also sets out the conclusions arrived at.

5-62. **Mechanical Parts Made From Powdered Metals.** Richard P. Seelig. *Steel,* v. 117, Nov. 19, '45, pp. 116-119, 156, 158, 163-164, 166, 168, 170, 172, 174, 176, 178.

Analyzes the possibilities and limitations of powder metallurgy as a means of producing machine parts. Equipment and processing outlook reviewed. Important expansion in field is predicted. 7 ref.

5-63. **Use of Zirconium in the Vacuum Tube.** Alfred N. Rogers. Electrochemical Society Preprint no. 88-19, Oct. '45, 6 pp.

Relative merits of binders and of various techniques of coating tube elements with the finely divided metal or hydride, discussed. Problem of zirconium powder waste disposal considered. Particular emphasis placed on handling of the two powders and manufacturing hazards involved. Precautionary measures outlined.

5-64. **Sectional Carbide Nib Molds.** *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 199-200, 202, 204.

Sectional nibs have produced per grind from seven to ten times the number of compresses possible with steel molds; they have equalled or surpassed the production of solid carbide nib molds, and, in addition, may be recut, with the production after each recutting being equal to production of the original mold.

5-65. **Sintered Carbide Blanking and Forming Dies.** *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 518-519.

Multiply by 10 to 1000 number of pieces produced per grind. Save users in down time several weeks' production per year. Lower production costs on many commodities.

5-66. **Powder Metal Machine Parts Design Characteristics and Data.** A. J. Langhammer. *Product Engineering,* v. 16, Dec. '45, pp. 877-879.

Characteristics of powder metals used in machine parts described; design considerations such as die shape, wall thickness, tolerances and control of hardness or porosity discussed; specific applications described.

5-67. **Powdered Metal Welding Rods.** *Steel,* v. 119, Dec. 10, '45, pp. 130, 133.

New processes for making alloy rods by compacting powdered metals around iron wire core.

5-68. **Reducing Costs With Powder Metallurgy.** Charles T. Pearson. *Production Engineering & Management,* v. 16, Dec. '45, pp. 89-92.

New and economical applications for powder metallurgy in production metal-working. New combinations of elements broaden production of pressure formed parts and afford additional opportunities for effecting savings in product cost.

SECTION VI

CORROSION

6-1. **Corrosion of Galvanized Coatings and Zinc by Waters Containing Free Carbon Dioxide.** L. Kenworthy and Myriam D. Smith. *Metallurgia,* v. 31, Nov. '44, pp. 13-18.

Premature failures in galvanized cold and hot water tanks led to an investigation of one of the controlling factors of corrosion of such tanks, the free carbon dioxide content of the water. Conductivity water, a hard public supply water, and a mixture of the two were tested at room temperature, and the hard water was tested also under conditions approximating those in domestic hot water systems. Various carbon dioxide contents were artificially maintained, and both zinc and galvanized mild steel were tested under each condition. (From *Journal* of the Institute of Metals.) 11 ref.

6-2. **Galvanized Coatings and Zinc.** *Chemical Age,* v. 51, Dec. 2, '44, p. 525.

Cold water corrosion; composition recommended.

6-3. **Diagnostic Methods in Problems Concerned with the Corrosion of Cans.** W. B. Adam and D. Dickinson. *Society of Chemical Industry Journal,* v. 63, Dec. 16, '44, pp. 426-428.

Presents a tentative scheme by which causes of hydrogen swells in canned fruits, resulting from corrosion of tinplate containers, may be determined. 3 ref.

6-4. **The Surface Film on Chromium-Nickel 18-8 Stainless Steel.** W. H. J. Vernon, F. Wormwell, and T. J. Nurse. *Metallurgia,* v. 31, Nov. '44, pp. 19-22.

Surface film, stripped from chromium-nickel (18-8) austenitic steel, has been studied and the metals present determined by chemical analysis. (Paper No. 15/1944, of the Corrosion Committee of Iron & Steel Institute, advance copy, Oct. '44.) 11 ref.

6-5. **Current Procedures in Operating So-Called Accelerated Weathering Units.** R. W. Matlack. American Society for Testing Materials *Bulletin,* no. 131, Dec. '44, pp. 34-36.

Results of questionnaire.

6-6. **Stress-Corrosion Cracking of Metals.** *Metal Progress,* v. 47, Jan. '45, pp. 75-78.

Stresses; corrosive environments; prevention; molten metal penetration; electrochemical nature of stress-corrosion cracking; notes on individual metals. (Summary of symposium held by American Society for Testing Materials and American Institute of Mining and Metallurgical Engineers.)

6-7. **Corrosion of Metals by Organic Acids in Hydrocarbon Solvents.** C. F. Prutton, D. R. Frey, D. Turnbull and G. Dlouhy. *Industrial & Engineering Chemistry (Ind. Ed.),* v. 37, Jan. '45, pp. 90-100.

Presence of oxygen or peroxides is a necessary condition for the corrosion of lead and cadmium by fatty acid solutions in hydrocarbon solvents. Although corrosion in these media will not take place to any large extent in the absence of acids, the rate of corrosion is mainly controlled by the rate of diffusion of oxidizing agent into the metal surface and by the chemical rate of oxidation of the metal rather than by acid strength or concentration. When an insoluble soap film is formed on the metal surface, the rate of corrosion is controlled by the rate of diffusion of the oxidizing agent through the film. Accumulation of lead soaps in solution markedly decreases the rate of corrosion of lead. 7 ref.

6-8. **Internal Corrosion of Tubing in Gas-Condensate Wells Measured by Recording Calipers.** E. H. Short. *Oil & Gas Journal,* v. 43, Jan. 6, '45, pp. 46-47.

Instrument which can be run inside the tubing strings under closed-in pressure to determine the magnitude of corrosion pits.

6-9. **Marine Corrosion.** F. Fancutt and J. C. Hudson. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 780-785.

Anti-corrosive compositions: Effect of pigment and medium.

6-10. **Fretting Corrosion, a Chemical-Mechanical Phenomenon.** Kurt Dies. *(Zeitschrift des V.D.I.,* v. 87, no. 29/30, July '43, pp. 475-476.) *Engineers' Digest* (American Edition), v. 2, Jan. '45, p. 14.

With the object of producing fretting oxides for chemical analysis and to examine their resistance to friction, a simple apparatus was constructed. Test specimens were prepared of various types of steel, tin, zinc, copper, light alloys and a plastic material "T3". Amount of wear occurring was estimated by weight measurements before and after the test. To promote removal of the fretting oxides from between the surfaces, slots were milled in the specimen. Throughout the tests, wear debris was collected in a container which was protected against contamination by oil and dirt.

6-11. **Corrosion Ratings of Metals.** *Steel,* v. 116, Jan. 22, '45, pp. 98, 101, 102, 104.

Because of wide interest in corrosion and its prevention in the immense storage job incident to reconversion, and the importance of corrosion effects in general, data given from Westinghouse Electric and Mfg. Co. are timely.

6-12. **Effects of Oxygen Exhaustion From Corrosive Solutions of High Nickel-Chromium-Molybdenum Alloy Steels.** W. E. Pratt. *Electrochemical Society Transactions,* v. 86, 1944 Reprint, 28 pp.

Procedures employed in discovering the causes of failures and the methods adopted for correcting the unusual corrosive conditions described. The information should prove helpful to both users and manufacturers of equipment made of such alloys.

6-13. **Cathodic Corrosion of Cable Sheaths.** Herman Halperin. Electrochemical Society Preprint no. 87-1, April '45, 14 pp.

Cathodic corrosion of cable sheaths has occurred with increasing frequency in an underground power cable system. Most troubles occurred where the conduits containing the cables are close to electric street railway track switches. Various methods have been used to retard the growing tendency for troubles due to cathodic corrosion. Also, special tests of potentials and leakage currents from a slug pulled through an idle duct were developed and used—in general with success—to detect underground locations having corrosive conditions, in order that steps could be taken to avoid service failures of cable. Further steps to reduce these troubles are (a) reduction of voltage drops on railway return systems and (b) development of an economical substitute for salt for use at track switches.

6-14. **Cathodic Protection of Steel Surfaces in Contact With Water.** Lee P. Sudrabin. *Water Works & Sewerage,* v. 92, Jan. '45, pp. 11-16.

Basic principles and controlling phenomena. 16 ref.

6-15. **Trans-Crystalline Corrosion Cracking of Boiler Preheater Tubes.** *VDI Zeitschrift,* v. 88, no. 17-18, April 29, '44, pp. 238-240.

An exhaustive investigation of trans-crystalline corrosion cracking of boiler preheater tubes produced from Siemens-Martin St. 35.29 steel was performed. The cause of such failures has been established as a chisel-action of oxide prying open the cracks.

6-16. **Silica Deposition in Steam Turbines.** F. G. Straub and H. A. Grabowski. *Combustion,* v. 16, Jan. '45, pp. 41-43.

Tests indicate that the silica leaves the boiler as vaporized silicic acid which later crystallizes on the blades in the lower pressure stages of the turbine. When the silica in the steam is below 0.1 ppm., no appreciable deposits are found in the turbines. Two methods of preventing deposits: (1) Maintain the silica in the boiler water below 5 ppm.; and (2) remove the silica from the steam by scrubbing with a pure grade water.

6-17. **Comparative Corrosion Resistance to Seawater of Low Alloy High Strength Steels.** J. F. T. Thomas and A. C. Halferdahl. *Canadian Chemistry and Process Industries,* v. 29, Jan. '45, pp. 43-46, 48.

Both laboratory and seawater tests are reported to

show the beneficial effects of small amounts of copper, nickel, chromium or molybdenum.

6-18. **New Design of Humidity Cabinet for Corrosion Testing.** Floyd Todd. *Metal Finishing,* v. 43, Feb. '45, pp. 56-59.

Cabinet described was designed to give an accurate and reproducible comparison of the relative efficiencies of corrosion preventives which are to be used under indoor storage conditions, including intermediate protection in the process of manufacture. 8 ref.

6-19. **Cathodic Protection of Steel Surfaces in Contact with Water.** Lee P. Sudrabin. *Water Works & Sewerage,* v. 92, Feb. '45, pp. 51-57.

Comments on the practical application of the process. 17 ref.

6-20. **Intergranular Corrosion of Stainless Steel Welds.** William T. Tiffin. *Welding Journal,* v. 24, Feb. '45, pp. 125s-128s.

Where austenitic welds are subjected to high temperatures and pressures, a desirable structure may be produced by heat treatment. The heat treatment should involve a quench from a suitable temperature which should be followed by a normalizing or spheroidizing treatment. Where the possibility of failure exists in "in-service" welds of the above type, similar means may be used to lessen the chances of subsequent failure. Moreover, where a suitable welding procedure is adopted, heat treatment may not be necessary unless peening of the weld metal is resorted to.

6-21. **Equipping a Corrosion Laboratory.** F. K. McKean. *Canadian Mining & Metallurgical Bulletin,* No. 394, Feb. '45, pp. 86-93.

Accent placed on the equipment selected; mention made of laboratory procedure, and results of a few preliminary tests recorded. 9 ref.

6-22. **Properties of Pure Boiler Feedwater.** *Combustion,* v. 16, Feb. '45, p. 45.

Because of the avidity with which pure water, such as condensate, takes up impurities, iron and copper from the condenser, the heaters, feed lines and pumps are often taken into solution. This is in the form of ferrous hydroxide which is subsequently broken down, under heat in the boiler, into magnetic oxide of iron, hydrogen and water. It is believed to account for much of the corrosion often found on last-stage turbine blades, in feed pumps, feed lines and the black oxide deposits in boiler tubes.

6-23. **Corrosion of Steel Salt-Bath Pots by Molten Alkali Nitrates.** R. J. Box and B. A. Middleton. Iron and Steel Institute Advance Copy, Jan. '45, 8 pp.

The corrosion of steel containers of salt bath furnaces by molten alkali nitrates was kept under observation simultaneously in several factories over two to three years. The furnaces were used for heat treatment of aluminum alloys at about 380 and 495° C., with variations in the quality of steel used for the pot, the shape

of the pot, and the type of salt employed. Details of analytical control found useful are given. Results obtained indicated that with commercially available salt of guaranteed purity (sodium chloride 0.3% max.) corrosion was negligible at 380° C., and proceeded only slowly at 495°. Where rapid attack took place the furnace design appeared to be a fairly prominent factor. For all practical purposes the use of ingot iron for the pot was a complete insurance against corrosion under the conditions described. The rate of increase of alkalinity of the melt was an index of the rapidity with which corrosion was taking place.

6-24. **Corrosion Ratings for Metals and Alloys.** H. D. Holler and R. A. Frye. *Westinghouse Engineer,* v. 5, March '45, pp. 56-59.

Weather forecasting and corrosion prediction have much in common. Neither can yet be done with high accuracy because both are fraught with so many interrelated and often unknown variables. In each field, experts have been steadily making headway; accurate predictions may not always remain outside scientific boundaries. Engineers of several organizations have pooled their experience with many commonly used metals and alloys. The resulting tables, although not absolute, can serve as guides for selecting the material most resistant to atmospheres (outdoor or industrial) or to sea water, paying particular attention to restrict their use to specific conditions.

6-25. **Weather-Proof Revolution.** Edwin Laird Cady. *Scientific American,* v. 172, March '45, pp. 145-146, 148.

Our armed forces needed containers that could withstand immersion in salt water and pass unscathed through the rough-and-tumble of battle. To meet this need the industry pooled its knowledge and trade secrets. The new weather-proof packaging will have many uses after the war.

6-26. **Standardization of the Salt Spray Corrosion Test.** *Products Finishing,* v. 9, March '45, p. 36.

Salt spray test can be used in the initial inspection of supplies to insure adequate protective surface treatment of all packing containers.

6-27. **Rust Prevention.** G. W. Pressell. *Industry & Power,* v. 48, March '45, pp. 70-72, 165-167.

Adequate knowledge of the causes and prevention of corrosion will help in protecting privately owned equipment during reconversion and will facilitate the preparation of idle government machines for shipment or storage.

6-28. **Recommendations for Using Steel Piping in Salt Water Systems.** Paul Ffield. American Society of Naval Engineers *Journal,* v. 57, Feb. '45, pp. 1-20.

Types of corrosion affecting iron and steel; corrosion resulting from direct action of salt water; corrosion rates in still water; corrosion rates in flowing water; corrosion rates in aerated water; potential difference between anode and cathode; relative areas of

anode and cathode; conductivity of the electrolyte; circuit resistance; proximity of anode and cathode; designing to minimize galvanic corrosion; eliminate the electrolyte; select materials of least potential difference; decrease the area of the cathode relative to the anode; use "waster pipes"; fouling by marine growths; pipe fouling by corrosion products; effectiveness of corrosion precautions.

6-29. **Corrosive Solutions.** W. E. Pratt. *Iron & Steel,* v. 18, Feb. '45, pp. 45-49, 52.

Effects of oxygen exhaustion on high nickel-chromium-molybdenum alloy steels. 4 ref. (Condensed from a paper presented at a recent meeting of Electrochemical Society in Buffalo, N. Y.)

6-30. **A Laboratory Machine for Investigating Corrosion of Bearings.** S. K. Talley, R. G. Larsen, and W. A. Webb. *Industrial and Engineering Chemistry* (Analytical Edition), v. 17, March 45, pp. 168-175.

Machine which simulates the more important mechanical factors leading to corrosion of bearings, and permits a study of factors which control the appearance and extent of bearing corrosion. Metallographic examination of corroded bearing sections indicates that the laboratory corrosion test specimens are nearly free of unwanted mechanical destruction and that corrosion penetration is more regular than in engine bearing specimens. Of the operating factors affecting bearing corrosion, temperature has been found to be especially important. 4 ref.

6-31. **Zinc Chromate Primers vs. Corrosion.** W. R. Barrett. *Organic Finishing,* v. 6, March '45, pp. 17-19.

Theory of corrosion; theory of zinc chromate primer corrosion inhibition; design of zinc chromate primers; uses for zinc chromate primers.

6-32. **Rust Preventives.** *Steel,* v. 116, April 2, '45, pp. 106-108, 149-150, 152, 154, 156.

What has been learned under stress of war about proper packaging to preserve metal parts against ravages of corrosion will be of benefit in peacetime product distribution and in storage or shipment of idle machines during the postwar adjustment period.

6-33. **Correcting Problems Caused by Scale and Corrosion in Compressor Stations.** Paul V. Sanders. *Petroleum Engineer,* v. 16, March '45, pp. 208, 212.

Bacteria, gases, dust and algae no longer need be allowed to destroy maximum efficiency in compressor stations.

6-34. **Mutual Influence of Electrodes and Its Importance for Corrosion.** G. V. Akimov. *Metallurgia,* v. 31, Feb. '45, pp. 219-220.

The weaker the cathodic polarization, the more electrodes function as anodes. Cathodic polarization can be reduced, e.g., by (1) introducing oxidizing agents into the solution, (2) increasing the area of the main cathode, or (3) raising the external resistance between the main anode and the main cathode. In some heat

treated aluminum-copper alloys the grain boundaries consist mainly of aluminum which has dissolved only about 0.3% of copper. Heating of chromium steels (and some chromium-nickel steels) leads to formation of inclusions of chromium carbide plus iron carbide.

6-35. **Emulsions of Oil in Water as Corrosion Inhibitors.** P. Hamer, L. Powell and E. W. Colbeck. Iron and Steel Institute, Advance Copy, Feb. '45, 18 pp.

Object of preventing corrosion in recirculating cooling-water systems, which was begun as a result of plant failures. Origin and object of the work discussed, together with the factors influencing the choice of experimental method. The oil emulsions referred to are those produced by adding "soluble oils" to water. These resemble the cutting oils employed on machine tools. Attention directed to the prevention of attack on mild steel. Three types of water have been used under both static and flow conditions at room temperature, and at 60 and 90° C. 7 ref.

6-36. **Corrosion of Steels in Marine Atmospheres and In Sea Water.** C. P. Larrabee. Electrochemical Society, Preprint 87-12, April 16, '45, 18 pp.

Data presented which show that the corrosion of steels in various atmospheres depends upon the amount and type of pollution and the composition of steel or alloy. Each composition must be tested in different locations for exact comparisons to be made. In sea water, plain and low alloy steels are shown to have an average corrosion rate of about 22 mg. per sq. dm. per day (0.004 in. per yr. average penetration). Pitting attack characterizes the corrosion of stainless steels although the presence of 2 to 3% molybdenum in the 18-8 type or very high alloy content diminishes this tendency.

6-37. **Stress-Corrosion Tests on Al-Zn-Mg Casting Alloy G54.** W. Bergmann. *Korrosion und Metallschutz,* v. 20, no. 1, Jan. '44, p. 67. British Non-Ferrous Metals Research Association *Bulletin,* v. 25, Feb. '45, p. 43.

Authors investigated: (1) The corrosion behavior of aluminum casting alloy G54 in form of fork specimens (*Gabelproben*) in tap water (pH 8.3 to 8.9), synthetic sea water, and 3% NaCl solution, under conditions of agitation, alternate immersion or spray; (2) effect of heat treatment (60 to 70° C.) on stress-corrosion under conditions given in (1); (3) effect of certain alloying additions (0.1 to 3% Si; 0.01 to 3% Th; 0.01 to 3% Cu; 0.01 to 1% V; and 0.1 to 1% Mn, Fe, Ti respectively) and additional heat treatment.

6-38. **Failure of Spring Loops by Stress Corrosion.** Given Brewer. *Metal Progress,* v. 47, April '45, pp. 707-712.

Experiments revealed corrosion cracking in the wire spring clips. High carbon, cold drawn wire is far more resistant to stress corrosion cracking than is heat treated wire of the same strength and chemical content. It is inadvisable to acid pickle heat treated high carbon steel after forming operations, or in any condition where high residual stresses are known to be

present. The range of temperature ordinarily assumed to accomplish stress relief was ineffective.

6-39. **Evaluating Rust Preventatives.** Bryant W. Pocock. *Products Finishing,* v. 9, April '45, pp. 32-34, 36, 38.

Procedure for evaluating rust preventatives, which purports to eliminate the uncertainties of older methods and to substitute a scientifically acceptable and reproducible technique.

6-40. **Clad Steels for Corrosive Service.** H. S. Blumberg. *Corrosion and Material Protection,* v. 2, April '45, pp. 11-16.

Discussion, limited entirely to "ferrous" group of bimetals, deals with the following topics: Need for clad steels; general properties of individual metals; backing materials; facing materials; description of the common methods for producing clad steels and their fabrication.

6-41. **Planning and Interpreting Corrosion Tests.** F. L. LaQue and B. B. Knapp. *Corrosion and Material Protection,* v. 2, April '45, pp. 17-23.

Corrosion tests made as a guide to the choice of a material for a particular purpose in connection with some process. Answer to the lack of correlation between conventional laboratory corrosion tests and results under actual service conditions is found in factors discussed. These are: Heating or cooling of metal surface; velocity; changes in corrosive character of solution; effect of critical concentration; vacuum and pressure; galvanic effects; concentration cell effects; effects of stress; effect of surface condition; effect of specimen size; heat treatment; improper duration of test; incomplete examination of corrosion test specimens.

6-42. **A Guide to the Selection of Corrosion - Resistant Piping Materials.** L. G. Vande Bogart. *Corrosion and Material Protection,* v. 2, April '45, pp. 25, 40-41.

Charts to provide an indication of the results that might be obtained from certain metal combinations.

6-43. **Corrosion Primer.** *Corrosion and Material Protection,* v. 2, April '45, pp. 31-33.

Definition, classification, and occurrence of corrosion discussed.

6-44. **Corrosion of Iron by Sulphides.** Richard Pomeroy. *Water Works & Sewerage,* v. 92, April '45, pp. 133-138.

Presentation of a few typical cases of corrosion caused by sulphides; descriptions of the selected examples, based on observations, followed by a brief discussion of the principles and comments pertaining to suggested remedial measures. 9 ref.

6-45. **Engineering Aspects of Water Corrosion.** *Corrosion and Material Protection,* v. 2, April '45, pp. 26-30.

Extended abstract of ten papers presented at the Fourth Annual Water Conference of the Engineers Society of Western Pennsylvania. Inhibitors; deaerating heaters; bacteria; steam condensate; water supplies; accelerator softeners; spiractor; boiler scale; zeolite; demineralizing.

6-46. **Corrosion of Nickel-Chromium-Iron Alloys.** *Alloy Casting Bulletin,* No. 4, March '45, pp. 1-7.

Influence of nickel and chromium content on penetration rates in air and flue-gas at high temperatures.

6-47. **A Variable Cycle Alternate Immersion Corrosion Testing Machine.** C. H. Mahoney, A. L. Tarr, and K. A. Skeie. American Society for Testing Materials *Bulletin,* no. 133, March '45, pp. 16-17.

Cycle machine tests up to 48 specimens or clusters of specimens in separate glass solution containers which are heated by a common thermostatically controlled bath. The specimens, suspended from the rack by means of glass stirrups, are raised and lowered alternately by a sprocket chain attached to a motor-driven cam. The immersion and aeration periods are automatically controlled by means of independent time switches which permit variations in the periods ranging from a few seconds to ½ hr.

6-48. **Glass Tanks for Pickling and Plating.** George L. West. *Metals and Alloys,* v. 21, Feb. '45, pp. 413-416.

Reports on the service properties and some applications of glass-lined and all-glass tanks, embodying a new high-strength and thermal shock resistant glass, for handling corrosive solutions in the metal working industries. The glass will thus be a competitor of corrosion resistant alloys for those jobs and for chemical process industries equipment as well.

6-49. **Memo on Cavitation.** Frank N. Speller. American Society for Testing Materials *Bulletin,* no. 133, March '45, pp. 21-22.

Definition, causes, and effects. 17 ref.

6-50. **Emulsions of Oil in Water as Corrosion Inhibitors.** P. Hamer, L. Powell and E. W. Colbeck. Iron & Steel Institute Advance copy, Feb. '45, 18 pp.

Investigation undertaken to prevent corrosion in recirculating cooling-water systems, which was begun as a result of plant failures. Origin and object of the work discussed, together with the factors influencing the choice of experimental method. The oil emulsions referred to are those produced by adding "soluble oils" to water. These resemble the cutting oils employed on machine tools. Attention has been chiefly directed to the prevention of attack on mild steel.

6-51. **The Comparative Effect of Carbon and Nitrogen on Intergranular Corrosion of 18-8 Stainless Steel.** Herbert H. Uhlig. Electrochemical Society Preprint 87-13, April 16, '45, 14 pp.

Effect of high nitrogen in 18-8 stainless steel on susceptibility to intergranular corrosion is of an order of magnitude less than that of carbon. Results, although possibly explained by nitride precipitation, call for a more comprehensive theory of intergranular corrosion than any based on precipitation of a chromium nitride or chromium carbide as an *a priori* factor in the mechanism. This is indicated by definite intergranular corrosion of an austenitic 18% Cr, 24% Ni, balance Fe alloy, heat treated at 500° C. (930° F.) for 169 hr. and exposed to $CuSO_4 + H_2SO_4$ solution, despite a carbon and nitrogen content of 0.004% and 0.006%

respectively. The mechanism of corrosion in this alloy and in 18-8 appears to involve grain boundary precipitation of a metallic phase.

6-52. **Relationships Between Corrosion and Fouling of Copper-Nickel Alloys in Sea Water.** F. L. LaQue and Wm. F. Clapp. Electrochemical Society, Preprint 87-15, April 16, '45, 20 pp.

Exposure of a series of copper-nickel alloys in natural sea water, under conditions which permitted detailed observations of the relationships between fouling and corrosion, disclosed that: In order for fouling to be prevented, copper must be released in corrosion products at a rate greater than 4.5 to 7 mg. per sq. dm. per day. Acceleration of corrosion by fouling organisms began in the early stages of fouling and was quite noticeable within 11 days after fouling had appeared. Alloys that fouled showed increases in corrosion rates when fouling developed as the period of exposure was prolonged. The results suggested that the sloughing off of solid corrosion products must be considered, along with toxicity, as a major factor in determining the fouling characteristics of metals and alloys in sea water.

6-53. **An Apparatus for Measuring Corrosion.** Morris Cohen. Electrochemical Society, Preprint 87-19, April 16, '45, 6 pp.

An apparatus has been developed for measuring the corrosion resistance of metals in solutions. Results of experiments are presented, which show good reproducibility. To illustrate the usefulness of the apparatus, the effect of time and the effect of three different waters on the corrision of steel are reported.

6-54. **Pipe Service Tests on Baltimore Water.** Charles F. Bonilla. Electrochemical Society Preprint 87-20, 17 pp.

Pitting of black and galvanized wrought iron and steel pipe carrying cold water, hot water, and returning condensate.

6-55. **Galvanic Corrosiveness of Soil Waters.** Howard S. Phelps and Frank Kahn. *Electrical Engineering*, v. 64, April '45, pp. 156-159.

Results of a study of the relation of pH of soil waters to galvanic action between couples of lead, copper, iron, and carbon. Galvanic-cell tests were made using as electrolytes actual soil waters or soil extracts from 31 locations at which trouble had been experienced. 3 ref.

6-56. **Cathodic Protection of Steel Surfaces in Contact with Water.** Lee P. Sudrabin. *Water Works & Sewerage*, v. 92, May '45, pp. 147-151.

Application of cathodic protection frequently presents a complex engineering design problem for successful results and economy; a comprehensive survey of the corrosion environment is the only recommended procedure. Any steel surface submerged in natural waters can be protected when an adequate current density, projected from a properly designed anode configuration within the corroding media is properly distributed. 14 ref.

6-57. **A Rapid Demonstration of Metaphosphate Protection.** A. A. Hirsch. *Water Works & Sewerage,* v. 92, May '45, p. 156.

Heavily chlorinated water samples furnished an effective medium to demonstrate the protection against corrosion afforded by sodium hexametaphosphate. Amount of rust formed seems the better evidence of protection. At high chlorine concentrations, all specimens of steel wool rust despite high metaphosphate dosage, but the rate of corrosion is retarded by increasing the metaphosphate treatment. 2 ref.

6-58. **An Investigation into Corrosion Caused by Aromatic Benzole Absorption Oil—III.** O. B. Wilson. *Coke & Smokeless-Fuel Age,* v. 7, April '45, pp. 73-77.

Composition and corrosion of iron; metallurgy of cast iron; plant experience; coating with a metal layer.

6-59. **Season or Stress-Corrosion Cracking—I.** *Metal Industry,* v. 66, April 27, '45, pp. 265, 268.

Nomenclature. 5 ref.

6-60. **External Corrosion of Furnace-Wall Tubes—I. History and Occurrence.** W. T. Reid, R. C. Corey, and B. J. Cross. American Society of Mechanical Engineers *Transactions,* v. 67, May '45, pp. 279-288.

Occurrence of external corrosion, 16 furnaces in 13 stations being examined. Corrosion was found to occur when the temperature of the tube metal was in the normal range for boiler furnaces, usually not exceeding 700° F, while the maximum temperatures observed were less than 900° F. Deposits in corrosion areas are shown to be of two types, one having the appearance of a bluish-white porcelain enamel, being largely soluble in water in which it produces an acid reaction, and consisting principally of sodium and potassium sulphates in a complex form. The second type is iridescent blue or black, is insoluble in water, may contain significant amounts of carbon, and consists primarily of iron sulphide. Because of the greater incidence of the sulphate deposit, its study was made first and is reported in detail.

6-61. **External Corrosion of Furnace-Wall Tubes—II. Significance of Sulphate Deposits and Sulphur Trioxide in Corrosion Mechanism.** R. C. Corey, B. J. Cross, and W. T. Reid. American Society of Mechanical Engineers *Transactions,* v. 67, May '45, pp. 289-302.

Objectives of the investigation were: To determine the factors involved in corrosion associated with enamel deposits; to determine the mechanism of corrosion; to reproduce this type of corrosion under controlled laboratory conditions; to devise means for retarding the rate of corrosion to a negligible rate, or arresting it completely, in operating furnaces.

6-62. **Chemical Corrosion of Some Remelted Aluminum Alloys.** Lilli Reschke. *Metall Wirtschaft,* v. 22, Nov. 20, '43, pp. 507-517.

6-63. **Chemical Corrosion of Standardized Sand and Chill-Cast Alloys (Short-Time Test in NaCl-H_2O_2 Solu-**

tion.). R. Sterner Rainer. *Metall Wirtschaft,* v. 22, Nov. 20, '43, pp. 517-522.

Corrosion behavior of a series of aluminum alloys tested in a 1% solution of common salt with 3% hydrogen peroxide added on heat treated materials (rough, ground, or polished). The "Eloxal" or "MBV" coating improved the resistance of most of the alloys.

6-64. **Laboratory Corrosion Tests.** R. M. Burns. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, May '45, pp. 299-302.

Critical review of laboratory corrosion tests, with description of methods of measurement, preparation of test specimens, and discussion of tests and testing facilities. 20 ref.

6-65. **Sea-Air Corrosion of Magnesium Alloys.** J. A. Peloubet. *Metals and Alloys,* v. 21, May '45, pp. 1327-1333.

Magnesium alloys are shown by cooperative coastal exposure tests to be surprisingly resistant, and in some cases to be actually among the best of the materials tested. Data on the relative merits in this respect of several magnesium alloys, aluminum alloys, mild steel and galvanized iron will correct some prevalent impressions of the relative corrodibility of magnesium alloys.

6-66. **Stress-Corrosion Cracking.** *Corrosion and Material Protection,* v. 2, May '45, pp. 17-24.

A correlated abstract. Mechanism of stress-corrosion cracking; tests for stress-corrosion cracking; cartridge brass; aluminum; miscellaneous alloys; aircraft; bridge cable; high nickel alloys; austenitic stainless steels; lead-antimony alloys. (From American Society for Testing Materials and the American Institute of Mining and Metallurgical Engineers Symposium.) 29 ref.

6-67. **Salt Water Corrosion on Plated and Unplated Stainless.** C. J. Strid. *Product Engineering,* v. 16, June '45, pp. 398-399.

With plain chromium corrosion resistant steel parts, a cadmium plate was generally specified for service in salt water atmospheres. Experiments on corrosion resistant 416 and 440 indicate that the cadmium coating may safely be omitted. Corrosion effects produced by salt water discussed.

6-68. **Report on Stress Corrosion Cracking of Boiler Plate Steel.** James T. Waber, Hugh J. McDonald, and Bruce Longtin. *Welding Journal,* v. 24, May '45, pp. 268s-273s.

Testing methods suitable for producing cracking; influence of such variables as heat treatment, stress level, chemical analysis of the steels, composition and acidity of the corroding solution; mechanism of stress corrosion cracking. 12 ref.

6-69. **Emulsions of Oil in Water as Corrosion Inhibitors.** P. Hamer, L. Powell and E. W. Colbeck. *Metallurgia,* v. 31, April '45, pp. 291-293.

Preventing corrosion in recirculating cooling systems. Attention has been chiefly directed to the prevention of attack on mild steel. Three types of water have been used under both static and flow conditions at room temperature, and at 60 and 90° C.

6-70. **Stainless Steels Minimize Corrosion in Processing Sour Crude Oils.** R. B. Tuttle. *Oil & Gas Journal,* v. 44, June 16, '45, pp. 104-106.

Findings show that metal losses in equipment increase to a maximum at the heavy gas-oil cracker. A loss of 25% in six months was found in the 4 to 6% Cr condensate line of the vapor separator.

6-71. **Abstracts From a Symposium on the Stress Corrosion of Metals and Alloys.** *Sheet Metal Industries,* v. 21, May '45, pp. 810-816.

A generalized theory of stress corrosion of alloys, by R. B. Mears, R. H. Brown, and E. H. Dix, Jr. The mechanism of the season cracking of brass, by H. Rosenthal. Residual stress in calibre 0.30 cartridge brass, by H. Rosenthal and J. Mazia. The assessment of the susceptibility of aluminum alloys to stress corrosion, by F. A. Champion. Elevated temperature tension tests on galvanized steels, by J. H. Craig. Stress-corrosion cracking of nickel and some nickel alloys, by O. B. J. Fraser. Some observations on stress-corrosion cracking in austenitic stainless alloys, by M. A. Scheil. Stress-corrosion testing of magnesium alloys, by W. S. Loose and H. A. Barbian. Protective resin films on cartridge brass, by H. Gisser. 26 ref.

6-72. **Diagnostic Methods in Problems Concerned with the Corrosion of Food Cans.** W. B. Adam and D. Dickinson. *Sheet Metal Industries,* v. 21, May '45, pp. 824-826.

Method of sampling; factors investigated; can factors; contents factors.

6-73. **The Effect of the Iron Content of Cupro-Nickel on Its Corrosion Resistance in "Sea Water."** A. W. Tracy and R. L. Hungerford. American Society for Testing Materials, preprint A2, 1945, 22 pp.

Data on a laboratory investigation concerning the effect of iron additions to cupro-nickels on the corrosion resistance of the alloys exposed to sea water in motion. The "sea water" was a 3% solution of sea salt. Sheet metal specimens were tested by attaching to fiber disks which were rotated in the test solution and tube specimens were placed in an experimental condenser. The extent of corrosion was determined on sheet metal specimens by measuring losses in thickness by means of sharp-pointed micrometers. Corrosion of tube specimens was judged from visual examinations.

6-74. **Electrolytic Corrosion—Methods of Evaluating Insulating Materials Used in Tropical Service.** B. H. Thompson and K. N. Mathes. *Electrical Engineering,* v. 64, June '45, pp. 295-299.

Selection of insulating materials to guard against electrolytic corrosion has become increasingly important as the use of electric devices in the tropics has

increased. Moisture conditions in the tropics are described, and means for producing such conditions in the laboratory are considered. The visual, corrosion-current, and water-extract conductivity methods for studying electrolytic corrosion are described. 2 ref.

6-75. **Season or Stress-Corrosion Cracking, II.** *Metal Industry,* v. 66, May 11, '45, p. 297.

Base mechanisms; ammonia cracking; grain boundary effects; brass; cartridge cases; electrochemical relationships.

6-76. **Corrosion and Biofouling of Copper-Base Alloys in Sea Water.** C. L. Bulow. Electrochemical Society, Preprint 87-26, 32 pp.

Copper alloys, of widely varied composition, were exposed to clean flowing sea water during which the water temperature ranged between 2 and 30° C. All of the specimens were covered with a slime after a few months' exposure. Some of the specimens showed excessive biofouling by relatively large marine flora and fauna. Alloys that were not biofouled to any extent showed marked increase in biofouling upon the addition of small percentages of aluminum, arsenic, and iron. Small additions of aluminum to certain copper alloys increased the resistance to impingement corrosion. Slight modifications of these alloys by the addition or subtraction of minor constituents of the alloys will, in many cases, greatly affect their corrosion resistance to clean flowing sea water.

6-77. **Scale-Forming and Corrosive Tendencies of Water Predicted by Rapid Methods.** Joe R. Wright. *Oil & Gas Journal,* v. 44, June 23, '45, pp. 99-100, 104, 107.

Previous methods of testing water and predicting corrosive or scale-forming tendencies have been criticized in that they are time consuming, expensive, and inexact. Method described has been shortened and simplified. Results are dependable because they have an exact mathematical basis. 13 ref.

6-78. **The Corrosion-Fatigue Properties of Some Hard Lead Alloys in Sulphuric Acid.** David J. Mack. American Society for Testing Materials, Preprint no. 32, 1945, 22 pp.

Fatigue properties of pure lead, tellurium lead, 1% antimonial lead and commercial storage battery lead were determined on a rotating beam machine of the cantilever type at 1785 rpm. in air, in 38% sulphuric acid, and in air after the specimens had been previously corroded in sulphuric acid while stress free. It was concluded that the corrosion-fatigue resistance of these alloys in sulphuric acid is a running balance between fatigue strength and corrosion resistance. 30 ref.

6-79. **Cathodic Protection.** L. H. Woodman. *Scientific American,* v. 173, July '45, pp. 44-46.

Pipelines and other underground metallic structures are constantly subject to corrosion caused by galvanic currents. Control of such corrosion can be obtained by the use of buried anodes which set up counter

potentials. Masses of magnesium offer a ready solution.

6-80. **A Theory of the Mechanism of Rusting of Low Alloy Steels in the Atmosphere.** H. R. Copson. American Society for Testing Materials, Preprint no. 25, 1945, 27 pp.

Analyses of selected rust samples presented, along with an examination of weather data and some weight losses. These results led to a new theory of the mechanism of rusting. In industrial atmospheres, copper and nickel in steel render sulphate corrosion products more insoluble by forming complex basic sulphates. On mild steel, sulphates in the rust are relatively soluble and promote corrosion but are washed away by rain. On alloy steels the sulphates are less soluble so that corrosion is slower, but less sulphate is washed away and more accumulates in the rust. The percentage of sulphate in the rust increases as weight loss decreases. At the marine location, severe corrosion of certain edges was due to soluble chlorides being swept to these edges by the wash of rain.

6-81. **What About Copper in Boilers?** Richard C. Corey. *Combustion,* v. 16, June '45, pp. 43-46.

Occurrence of copper deposits in high-pressure boilers and diverse opinions as to its possible detrimental effects; reviews the chemistry involved. No valid evidence has yet been produced to show that metallic copper, or copper oxide deposits, will cause corrosion.

6-82. **Electrical Methods of Water Treatment.** *Power Plant Engineering,* v. 49, July '45, pp. 80-81.

Use of zinc bars or balls in boilers to reduce corrosion. Use of direct current with boiler as anode. Ozone, electro-osmotic system of purification; ultraviolet radiation; use of silver in water sterilization; present-day cathodic protection methods.

6-83. **The Corrosion of Food Cans.** W. B. Adam and D. Dickinson. *Sheet Metal Industries,* v. 21, June '45, pp. 1009-1010.

Diagnostic methods. 3 ref.

6-84. **Theory of Stress Corrosion Cracking of Mild Steel in Nitrate Solutions.** J. T. Waber, H. J. McDonald and B. Longtin. Electrochemical Society, Preprint 87-32, pp. 439-461.

Stress corrosion cracking of mild steel in nitrate solutions is shown to depend upon the stress-accelerated age hardening of the steel. A correlation between the cracking times and the extent of aging was made. Both the extent of aging after a standard treatment and the rate of cracking after several heat treatments were correlated with the free nitrogen factor. 60 ref.

6-85. **How Metals Behave in Sea Air.** *Heating & Ventilating,* v. 42, July '45, pp. 83-84.

Specimens of various metals and alloys exposed to the salt water atmosphere at Kure Beach to determine the ability of the metals and coatings to resist sea air corrosion.

6-86. **Resistance of Clad 24S Aluminum Alloys.** *Automotive Industries,* v. 93, July 1, '45, p. 29.

Results of tests during which clad 24S, aged and unaged, was exposed to a salt spray solution for 500 hr. and to an accelerated corrosion media containing salt and H_2O_2 for a 48-hr. period indicate that the yield and ultimate strengths of both types were not affected by either of the corrosive solutions. The elongation of both materials was reduced approximately 2% by the above applicable specifications.

6-87. **Corrosion Research Project at Kure Beach Test Station.** Harry W. Stenerson. *Chemical and Engineering News,* v. 23, July 10, '45, pp. 1160-1163.

At Kure Beach, long-term research is going on in metal corrosion in sea water from chemical action, galvanic current, and from marine organisms such as the Teredo. Many alloys and protective finishes are being tested under exacting conditions.

6-88. **A Commentary on Corrosion Testing.** *Corrosion & Material Protection,* v. 2, June '45, pp. 19-20, 17.

Considers the possible procedures in corrosion testing program.

6-89. **Rust Preventives in the Production Cycle.** D. W. Prichard. *Products Finishing,* v. 9, July '45, pp. 44-46, 48, 50, 52.

Places where corrosion is most apt to develop are where the metal surface of the part is left "chemically clean" and devoid of any protective oil film; after grinding or machining with water soluble coolants; after machining, tapping or threading operations with bases of the sulphur-chlor type having a definite staining action upon steel alloys; and after tumbling parts with granite chips in an aqueous alkaline solution for the purpose of "breaking" sharp corners or removing heat treating or quenching scales.

6-90. **Corrosion Primer.** *Corrosion & Material Protection,* v. 2, June '45, pp. 21-22.

Hydrogen ion concentration.

6-91. **Further Observations on the Protective Influence of Manganese in the Corrosion of Aluminum-Containing Magnesium Alloys.** F. A. Fox and C. J. Bushrod. Institute of Metals *Journal,* v. 71, May '45, pp. 255-265.

Magnesium alloys of the chemical composition required by D.T.D. specification 59A have been examined for corrosion resistance. Material in the solution-treated condition corrodes faster than that in other states when tested by complete immersion, irrespective of the iron content; under conditions of atmospheric exposure, however, the material in all three structural states shows similar corrosion resistance. Possible reasons for this difference in behavior under the two conditions of test are discussed. 4 ref.

6-92. **Corrosion Resistance of Clad 24S Aluminum Alloys.** C. M. Marshall. *Automotive Industries,* v. 93, July 1, '45, pp. 28-29.

Results of tests during which clad 24S, both aged and

unaged, was exposed to a salt spray solution for 500 hr. and to an accelerated corrosion media containing salt and H_2O_2 for a 48-hr. period indicate that the yield and ultimate strengths of both types were not affected by either of the corrosive solutions. Elongation of both materials was reduced approximately 2% by the above exposure but remained above applicable specifications.

6-93. **Comparative Corrosion Resistance of Steels in Marine Atmospheres and in Sea Water.** *Steel,* v. 117, July 23, '45, pp. 122, 157.

Experiments indicate that corrosion rate of an unprotected steel is dependent on compositions. Low alloy, high strength steels, with superior corrosion resistance in industrial atmospheres, also are more resistant in marine atmospheres, but to varying extents. To obtain untarnishable steel, a very high alloy content is necessary, with its attendant higher costs. Zinc-coated products are highly satisfactory under many conditions and worthy of consideration in any proposed service.

6-94. **Old Man Corrosion at the Refinery.** William F. Kramer. *Pure Oil News,* v. 28, Aug. '45, pp. 12-16.

A destructive and continuous inhabitant working under cover to increase hazard and cost. Methods used to stop it.

6-95. **Tests on Iridite Finish for Cadmium and Zinc Plated Steel.** Kenneth E. Dorcas and N. H. Simpson. *Iron Age,* v. 156, July 26, '45, pp. 61, 143.

Independently made tests indicate that the iridite treatment applied to either cadmium or zinc plate results in greater corrosion resistance than untreated plate, this chemical finish being more essential for zinc than for cadmium plate.

6-96. **Marine Tests Rate Alloy Performance.** J. Albin. *Iron Age,* v. 156, July 26, '45, pp. 62-67, 82.

Research on corrosion of metals at Kure Beach, N. C., over a period of ten years should stimulate alloy development and design of apparatus to suit corrosion characteristics of metal. Many data have been amassed to predict by color and texture in the early stages the total performance of rust in steels. Extensive tests are in process on the corrosion resistance properties of magnesium alloys in aircraft applications.

6-97. **Erosion Tests of Cast Alloys in Sea Water.** L. R. Voigt. *Inco,* v. 19, no. 4, 1945, pp. 9-11.

Used to confirm practical experience with pump impellers and provide additional technical data.

6-98. **Light Alloys Under Marine Conditions.** *Light Metals,* v. 8, July '45, pp. 308-318.

Results of exposure tests on a range of small castings in light and ultra-light alloys, subjected to different protective treatments, during a prolonged voyage with wide variations of climate and corrosion hazard.

6-99. **Corrosion in Magnesium Alloys.** James L. Erickson. *Light Metal Age,* v. 3, July '45, pp. 12-14, 40.

Reviews the nature and mechanism of the corrosion of magnesium and magnesium alloys with special reference

to how the corrosion resistance of this light metal affects its industrial applications and what steps are being taken by the magnesium producers to furnish the magnesium buyer with magnesium alloys of improved corrosion resistance. 4 ref.

6-100. **Petroleum Base Rust Preventive.** G. A. Durham. *Western Machinery & Steel World,* v. 36, July '45, pp. 314-317, 335.

Petroleum-type materials offer advantages of ease of application, economy, ease of removal; dimensions and surfaces of finely finished parts are not affected; oil-type products may also function as lubricants; certain other advantages are apparent in specific applications.

6-101. **Avoiding "Smut" from Aluminum Etchants.** Fred Tauber. *Iron Age,* v. 156, Aug. 2, '45, p. 57.

Fluoride preparations used as etchants for aluminum sheets prior to spot welding in many cases leave a black film on the surface of the etched metal. Recently it has been demonstrated that this smut may be "decoyed" from depositing on the product by taking advantage of a well known principle of electrochemistry involving the electromotive series of metals.

6-102. **Corrosion in the Tropics.** George W. Grupp. *Metal Finishing,* v. 43, Aug. '45, pp. 326-328.

Metal finishes and organic protective coatings, which are thought to be reasonably durable are quickly laid low by the agencies of corrosion under the tropical conditions of the Central and South Pacific. Causes of trouble and some of the solutions found.

6-103. **Low Carbon Steel.** A. Wachter and N. Stillman. *Iron & Steel,* v. 18, July '45, pp. 239-240.

Corrosion by phenol at high temperatures.

6-104. **Use of Soluble Inhibitors.** U. R. Evans. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 703-705.

Factors deciding between corrosion and inhibition. When the immediate corrosion product is sparingly soluble, attack is likely to be stifled. Anodic inhibitors function by forming a sparingly soluble anodic product. Cathodic inhibitors form sparingly soluble products on the cathode areas. 13 ref.

6-105. **Zinc, Manganese, and Chromic Salts as Corrosion Inhibitors.** R. S. Thornhill. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 706-708.

Data presented showing that the rate of corrosion of steel in tap water is reduced by adding small quantities of zinc and manganese salts; chromic salts bring about a certain measure of inhibition at low, but not high concentrations. At relatively high concentrations of zinc and chromium, marked intensification occurs in the water-line zone; manganese salts are free from this defect, since the water-line zone is not attacked.

6-106. **Threshold Treatment of Water Systems.** G. B. Hatch and Owen Rice. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 710-715.

Corrosion and the deposition of calcium carbonate and

iron oxide in water systems may be controlled by treatment with very low concentrations of the molecularly dehydrated phosphates. 38 ref.

6-107. **Protection of Small Water Systems from Corrosion.** William Stericker. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 716-720.

The life of piping and plumbing fixtures can be greatly increased by the addition of small amounts of sodium silicates to the water passing through them. Hot water can be treated by passing a small part of it over $Na_2O:3.3SiO_2$ glass. Field tests show improved conditions with steel after 17 years of treatment. Yellow brass is also protected. 17 ref.

6-108. **Galvanic Corrosion of Steel Coupled to Nickel.** H. R. Copson. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 721-723.

Galvanic corrosion tests on steel coupled to nickel in tap water. With a 3 to 1 area ratio of nickel to steel, galvanic corrosion of the steel was appreciable but not excessive. Treating the water with 300 parts per million of sodium chromate practically inhibited corrosion, provided the steel was rubbed occasionally. Undisturbed steel was liable to pitting. Treating the water with lime to pH 11 cut down the total corrosion but localized it, with the result that the maximum rate of penetration was increased. 4 ref.

6-109. **Inhibitors of Corrosion of Aluminum.** G. G. Eldredge and R. B. Mears. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 736-741.

Inhibitors for aluminum behave differently in various acids. Chromates are effective in phosphoric acid but not in hydrochloric. Nitrogen compounds and pickling inhibitors that are effective for steel are usually more effective for aluminum in hydrochloric than in phosphoric acid. No very effective inhibitors for aluminum in sulphuric acid are known. In waters, chromates, silicates, and soluble oils were most effective. Against galvanic corrosion by contact with copper, the same materials functioned to some extent, especially when the sodium chloride content was as low as 10 p.p.m. 52 ref.

6-110. **Chromate Corrosion Inhibitors in Bimetallic Systems.** Marc Darrin. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 741-749.

When dissimilar metals are in contact in an aqueous medium, the corrosion of one of the metals is accelerated. Report describes the technology, rather than the theory, of inhibiting this kind of corrosion by means of chromate, under conditions encountered in practice. The effects of time of exposure, temperature, aeration, submergence of panels, initial pH, and chromate concentration are shown as they influence the corrosion of various bimetallic systems. 26 ref.

6-111. **Sodium Nitrite as Corrosion Inhibitor for Water.** A. Wachter. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 749-751.

Sodium nitrite is a good corrosion inhibitor for water

and under many conditions can completely suppress the corrosion of steel. Concentrations of nitrite needed for pronounced inhibition vary with the severity of conditions and the pH and composition of the water. 4 ref.

6-112. **Corrosion Control With Threshold Treatment.** G. B. Hatch and Owen Rice. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Aug. '45, pp. 752-759.

Factors in formation of protective films upon steel by waters treated with glassy phosphates. 10 ref.

6-113. **Future Metals.** Irwin H. Such. *Steel,* v. 117, Aug. 13, '45, pp. 110-113, 158, 160.

Proving ground for measuring the corrosion resistance of iron and steel and the non-ferrous metals at Kure Beach. Devoted to the effects of sea air and salt water, the studies constitute an excellent measure of the relative corrosion resistance of metals and alloys and finishes for metals, because of the unusually severe conditions encountered.

6-114. **Ferrous Piping Systems in Building.** H. L. Shuldener. *Corrosion & Material Protection,* v. 2, Aug. '45, pp. 6, 8, 10-12.

Suggestions for lengthening the useful life.

6-115. **The Reaction of Copper and Oxygen Saturated Ammonium Hydroxide.** R. W. Lane and H. J. McDonald. *Corrosion & Material Protection,* v. 2, Aug. '45, pp. 17-28.

Corrosion of copper by ammonia in steam power plants using surface waters as their boiler feed water. Knowledge of the mechanism or rate-determining step of the reaction of copper and ammonia should be of considerable value in determining the best method for inhibiting the reaction.

6-116. **Corrosion of Steels in Marine Atmospheres and in Sea Waters.** C. P. Larrabee. *Western Metals,* v. 3, Aug. '45, pp. 18-19.

Sulphur dioxide contaminated atmosphere at industrial locations, especially where the contamination was greatest, caused more corrosion than the sea salt deposited on the specimens at any marine site. At most locations where a succession of samples was exposed, considerable variation was found in the loss of weight during each of the five successive years.

6-117. **The Control of Oxidation on Zinc.** Michael P. Bruno. *Modern Lithography,* v. 13, June '45, pp. 43, 45, 47, 49, 77.

Solution composition; dipping time; draining and washing; drying; color; life of solution; cost; limitation on use; properties of the Cronak coating.

6-118. **The Use of a Tin Undercoat to Improve the Corrosion Resistance of Painted Steel.** Ernest S. Hedges and L. A. Jordan. Iron & Steel Institute, Advance Copy, July '45, 9 pp.

Effectiveness of tin undercoats on painted steel in retarding corrosion has been examined. The investigations covered electrodeposits of tin from both the alkaline and acid tin baths, using thicknesses of 0.000008 and 0.00003 in., and the effect of flash-melting the tin coatings and of oxidizing the tin surface by chemical treatments; in

addition, specimens of plain steel, hot-dipped tinplate and phosphated steel were included in the series. Twelve different paints were applied, including linseed-oil paints, nitro-cellulose lacquer, stoving paints, and air-drying japans. Accelerated corrosion tests show that treatment with electrodeposited tin, especially when followed by the application of the T.R.I. (Tin Research Institute) anti-rusting oxide film, adds very greatly to the protection afforded by the paints. The best treatment was 0.00003 in. of tin electrodeposited from the sodium stannate bath and further protected by the T.R.I. film.

6-119. **Ethylcellulose Coatings Protect Metal Parts From Corrosion.** F. L. Gerin. *Corrosion & Material Protection,* v. 2, Aug. '45, pp. 13-15.

Method of packaging military equipment for overseas shipment evolved using compounds of ethylcellulose. Complete protection from damage by corrosion during shipping or from long storage in any climate is provided by this compound.

6-120. **Stress-Corrosion Cracking.** J. W. Donaldson. *Metal Treatment,* v. 12, summer '45, pp. 106-115.

Review of some of the papers on stress-corrosion cracking presented at a joint symposium of the American Society for Testing Materials and the American Institute of Mining and Metallurgical Engineers. 2 ref.

6-121. **Corrosion of Aluminum by Die Materials.** P. A. Haythorne. *Iron Age,* v. 156, Sept. 20, '45, pp. 72-73.

Investigation concerned with the corrosion of Alclad 24S sheet metal parts formed on low-melting alloy dies. Application of a heavy-bodied lubricant to both dies and Alclad sheet goes far in preventing the embedding of corrosive particles.

6-122. **Corrosion Prevention by Controlled Calcium Carbonate Scale.** Sheppard T. Powell, H. E. Bacon, and J. R. Lill. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Sept. '45, pp. 842-846.

Use of controlled calcium carbonate scale for corrosion prevention in cooling tower systems serving steel equipment has been investigated at plants constructed for war production, when copper alloys were scarce. Study revealed factors that markedly affect the success of the treatment, which have hitherto had little recognition. If rising temperatures cause the actual pH of the water to drop at the same rate as the calcium carbonate saturation pH, scale of uniform thickness will be deposited over the entire temperature range. 4 ref.

6-123. **Corrosion of Aluminum.** P. A. Haythorne. *Metal Industry,* v. 67, Sept. 7, '45, pp. 146-147, 149.

Results of an investigation concerned with the corrosion of Alclad 24S sheet metal parts formed on low melting alloy dies. Includes a brief description of corrosive attack, a solution of the problem and recommendations to insure against further occurrence.

6-124. **Piston Lacquering—Its Causes and Cure.** H. C. Mougey. *SAE Journal,* v. 53, Oct. '45, pp. 582-587.

Formation of varnish or lacquer deposits on pistons and

other engine parts is closely related to the formation of sludge deposits. Problems divided into three classes: Low temperature, intermediate temperature, high temperature. Cause of the low-temperature sludges is water, and varnish is usually not a serious problem at the low temperatures. Cause of the intermediate-temperature sludges appears to be the fuel and in some cases the oil, and varnish may be serious at the intermediate temperatures.

6-125. **Fuel Economy Discussions, VI.** W. Murray. *Chemical Age,* v. 53, Sept. 8, '45, pp. 215-219.
Inhibition of corrosion of metal in contact with water or steam. Electrolytic corrosion theory; typical examples of corrosion; examples of successful inhibition; present water treatment practice; the future.

6-126. **Corrosion Tests Yield Interesting Data.** *Railway Age,* v. 119, Oct. 13, '45, pp. 594-597.
Thousands of specimens of metals, alloys and coatings studied at Kure Beach. Methods of timber preservation also investigated to determine resistance to marine borers.

6-127. **Magnesium for Cathodic Protection.** Arthur Smith. *Modern Metals,* v. 1, Oct. '45, pp. 22-23.
How corrosion occurs and how anodes are produced, positioned, etc., to combat galvanic corrosion.

6-128. **Corrosion Resistance of the Stainless Steels.** Carl A. Zapffe. *Metal Progress,* v. 48, Oct. '45, pp. 693-696, 697-707.
Definitions of stainless steels and passivity; effect of condition of the steel; resistance to acids; resistance to strong bases and other media; galvanic corrosion; erosion-corrosion. Tables of specific data on corrosion rates of various steels in various corroding media.

6-129. **How to Protect Motor and Machine Components.** L. G. Klinker. *Iron Age,* v. 156, Oct. 15, '45, pp. 64-68, 176B.
Types of corrosion problems encountered and the means developed to minimize failures and deterioration.

6-130. **The Acid Corrosion of Magnesium.** G. E. Coates. Institute of Metals *Journal,* v. 71, Sept. '45, pp. 457-480.
Corrosion rate of magnesium in dilute acids has been measured by a flow method; over wide ranges the logarithm of the corrosion rate is linearly proportional to the logarithm of the acid concentration. Measurement of the concentration-polarization properties of the same acids, and a comparison of these with corrosion rate data, are taken to confirm the diffusion control mechanism and lead to a quantitative interpretation of acid corrosion rates. The potentials of magnesium during acid corrosion have also been measured, but, although qualitatively explained as the sum of the two terms hydrogen overvoltage and concentration polarization, no exact interpretation has been obtained. 22 ref.

6-131. **Stress Corrosion Cracking of Mild Steel.** *Sheet Metal Industries,* v. 22, Sept. '45, p. 1562.
Theory of stress corrosion; correlation between aging and stress corrosion; effect of nitrogen; experimental procedure. (Electrochemical Society.)

6-132. **The Canning Method for Preserving Ordnance.** *Corrosion and Material Protection,* v. 2, Oct. '45, pp. 7-9, 14.

Canning guns and other large weapons to preserve them for future use. An entire weapon such as a 90-mm. anti-aircraft gun is placed in a huge metal can and hermetically sealed. The air is exhausted and an inert gas such as nitrogen or helium used to replace it, along with the desiccant silica gel. This system permits the storage of weapons or other articles indefinitely without the necessity of frequent inspections.

6-133. **The Factor of Corrosion in the Cleaning and Processing of Metals.** S. G. Thornbury. *Corrosion and Material Protection,* v. 2, Oct. '45, pp. 15-16, 29.

Two basic causes of corrosion as a result of the cleaning process must be considered. Corrosion may result from a direct chemical reaction between the cleaning agent and the metal being treated, or it may result from an electrolytic reaction between two or more metals, in which the cleaning solution acts as an electrolyte. In both cases, corrosion can be altogether prevented or held to a minimum if the chemical and electrolytic behavior of the metal being treated and the cleaning compound are clearly understood.

6-134. **Potential Curves for Iron in Hydrochloric Acid.** Robert D. Misch and Hugh J. McDonald. *Corrosion and Material Protection,* v. 2, Oct. '45, pp. 17-20.

Examination of the results for each concentration shows that in all cases the potential is highest (more negative) at the end of a trial for the acid solution as made up and lowest for the solution in which oxygen was bubbling. The curve for the oxygen saturated solution lies in an intermediate position. The average values for the e.m.f. at 3000 sec. (50 min.) after immersion for each trial are given.

6-135. **Corrosion of Lead by Oxidizing Agents and Lauric Acid in Hydrocarbon Solvents.** C. F. Prutton, David Turnbull and D. R. Frey. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Oct. '45, pp. 917-924.

Rates of corrosion of pure lead by representative organic peroxides in hydrocarbon media containing organic acids are compared. Organic oxidizing agents other than peroxides or oxygen may be effective in causing corrosion of lead in these media; oxy-nitrogen compounds, quinones, and diacetyl are agents of this type. Reactivities of oxidizing agents toward lead are compared at a constant acid concentration. To evaluate the effective corrosivity of an oil, it is necessary to consider the thermal stability of the oxidizing agent as well as its chemical reactivity. Evidence is cited to show that oxy-nitrogen compounds, as well as peroxides and oxygen, may be among the oxidizing agents present in oils.

6-136. **Investigation of a Type of Failure of 18-8 Stabilized Stainless Steel.** Walter Kahn, Harold Oster and Richard Wachtell. American Society for Metals Preprint 15, 1945, 17 pp.

Deals with a type of high temperature failure found in

18-8 stabilized stainless steel, much of which has been used in modern aircraft exhaust systems. With perhaps greater emphasis than is generally found in the literature, a type of failure is traced which appears to be due to carburization of the stainless steel by exhaust gases under certain conditions. It has been shown that if more carbon is introduced than can be absorbed by the stabilizing element, actual carburization takes place, and deterioration of the stainless steel occurs as though no stabilizing element were present.

6-137. **Zinc Yellow—A Corrosion-Inhibitive Pigment.** W. F. Spengeman and D. H. Lawson. *Paint, Oil & Chemistry,* v. 108, Oct. 4, '45, pp. 9-10, 12, 28.

History; composition; manufacture; properties; use in corrosion-inhibitive primers. 17 ref.

6-138. **Corrosion Stability of Magnesium Alloys.** *Light Metals,* v. 8, Oct. '45, pp. 492-505.

Discusses corrosion resistance of the ultra-light alloys in terms of a high purity magnesium base versus one of normal purity coupled with high manganese. Care needed in interpreting salt-spray test results as guides to performance in service. 13 ref.

6-139. **Inhibition of Corrosion of Metal in Contact With Water and/or Steam.** W. Murray. *Gas Times,* v. 44, Sept. 22, '45, pp. 7-9.

Discusses methods of inhibition of corrosion of metal and gives some consideration to the reason for the occurrence of corrosion and its mechanism.

6-140. **Assessing Wear Due to Friction and Corrosion.** Phillip M. Fisk. *Iron Age,* v. 156, Oct. 25, '45, pp. 65-67.

Although it has been well known for many years that metals in contact with each other form couples and that in general the more electropositive metal corrodes, little data have appeared in the literature to add to the understanding of corrosion due to frictional wear. This problem as applied to door hinges specifically, but equally applicable to any sheet metal part subject to similar service conditions, was thoroughly investigated by the use of a specially designed testing machine. Complete design details of this testing device and the computation of results, first appearing in *Sheet Metal Industries,* London, presented.

6-141. **Cathodic Protection Controls Polarity to Buck Corrosion Current.** L. P. Sudrabin. *Power,* v. 89, Nov. '45, pp. 76-79.

Method stifles the current flow that accompanies metal corrosion (electrochemical theory) by superimposing a regulated current flow from a properly placed special anode through the corroding liquid to metal surface protected. (Abstract of paper for Engineers Society of Western Pennsylvania.)

6-142. **Report of Committee A-5 on Corrosion of Iron and Steel.** American Society for Testing Materials Preprint 4, 1945, 21 pp.

Reports subcommittees engaged in making periodic inspections of black sheet, galvanized sheet, and wire and

wire products exposed to outdoor weathering. Report of Subcommittee III on Inspection of Annapolis Tests (specimens of copper-bearing and non-copper-bearing corrugated black sheets). Report of Subcommittee VIII on Field Tests of Metallic Coatings (galvanized sheet exposure tests; exposure tests of metallic-coated hardware). Report of Wire Inspection Committee on Field Tests of Wire and Wire Products (atmospheric corrosion tests on wire and wire product specimens after exposure for about eight years at each of eleven locations).

6-143. **The Corrosive Action of Benzole Absorption Oils.** C. M. Cawley and H. E. Newall. Society of Chemical Industry *Journal,* v. 64, Oct. '45, pp. 285-290.

Investigation to determine nature and origin of substances causing corrosion in benzole absorption plants. Result of the work shows main cause of corrosion is action of ammonium thiocyanate, which is formed, at least in part, by reaction between ammonia and carbon disulphide in solution in wash oil.

6-144. **Silica Gel Did Its War Work Well.** R. G. Skerrett. *Compressed Air Magazine,* v. 50, Nov. '45, pp. 280-285.

Describes the variables encountered and overcome in preventing corrosion of materiel by the use of silica gel.

6-145. **High Pressure Corrosion.** *Corrosion & Material Protection,* v. 2, Nov. '45, pp. 11-12, 20.

Effect of pressure; softening of steel at high temperatures; specific cases in which no corrosion was found; specific cases in which corrosion did occur; protective coatings.

6-146. **Stress Corrosion Cracking of Mild Steel, Part I.** James T. Waber and Hugh J. McDonald. *Corrosion & Material Protection,* v. 2, Nov. '45, pp. 13-22.

Explanation of selective grain boundary corrosion of mild steel, duralumin, and stainless steel. Corrosion cracking shown to be dependent upon precipitation of some material rather than upon hardening by aging. Caustic embrittlement shown to be dependent upon precipitation of iron nitride from ferrite. Effect of elements such as aluminum and titanium was to render steel non-aging and, by combining with the nitrogen, to prevent nitride precipitation. Other additions probably inhibit the precipitation. Phosphorus and oxygen decrease (in all probability) the solubility of nitrogen and carbon in ferrite. 101 ref.

6-147. **A Modified Salt Spray Test for Chromium Plated Zinc Base Die Castings.** C. F. Nixon. *Monthly Review,* v. 32, Nov. '45, pp. 1105-1108.

Discussion of considerations which led to formulation of the acetic acid salt spray.

6-148. **Stress Corrosion in Light Alloys.** H. G. Petri, G. Siebel and H. Vosskuhler. *Light Metal Age,* v. 3, Nov. '45, pp. 23-28, 41.

Describes effect on the resistance to stress corrosion of Al-Mg-Zn alloys of the addition of cerium, titanium, copper, manganese, chromium, vanadium, iron, silicon, increased magnesium, zinc content and other factors.

6-149. **Reasonable Life of Steel Casings Immersed in Sea Water.** W. D. Faucette, D. J. Brumley, Benjamin Elkind, J. D. Moffat, W. G. Nusz, F. N. Nye, G. P. Palmer, J. P. Ray, E. F. Wendt. American Railway Engineering Association *Bulletin* 455, v. 47, Nov. '45, pp. 108-112.

Corrosion tests in sea water at Kure Beach, N. C.

6-150. **Marine Corrosion and Erosion.** J. W. Donaldson. *Metal Treatment*, v. 12, Autumn, '45, pp. 159-170.

Raft tests; anti-fouling investigations; anti-corrosive compositions for underwater service; corrosion and fouling; sea action committee (civil engineers); American tests; galvanic corrosion; paint tests; cavitation erosion. 16 ref

6-151. **Corrosion in Hydrofluoric Acid Alkylation.** M. E. Holmberg and F. A Prange. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, Nov. '45, pp. 1030-1033.

As a result of both the pilot plant work and more than two years of experience in operation of commercial HF alkylation units, company has accumulated extensive data on corrosion of metals in hydrofluoric acid; presents some of the metallurgical information gained.

6-152. **Corrosion Resistance.** *Metal Industry,* v. 67, Nov. 2, '45, p. 279.

Effect of copper on strength and resistance of Al-Zn-Mg-Cu alloys.

6-153. **Corrosion as Encountered on Naval Aircraft and Methods of Prevention.** *Corrosion & Material Protection,* v. 2, Dec. '45, pp. 9-12.

Explains the "why" of rigid specifications for protection.

6-154. **Stress Corrosion Cracking of Mild Steel, Part II.** James T. Waber and Hugh J. McDonald. *Corrosion & Material Protection,* v. 2, Dec. '45, pp. 13-16.

The accelerated-precipitation theory of stress corrosion. 34 ref.

6-155. **Corrosion Primer.** *Corrosion & Material Protection,* v. 2, Dec. '45, pp. 20-21.

Soil corrosion. Table gives description of typical profiles in the great soil groups.

SECTION VII

CLEANING AND FINISHING

7-1. **The Siliconizing of Steel.** D. McPherson. *Machinery* (London), v. 65, Nov. 23, '44, pp. 571-573.

Siliconizing or Ihrigizing is a diffusion process which can be included under the group known as solid-vapor systems. Nature of the process; structure and composition of the silicon case; materials treated; physical properties; corrosion resistance; wear resistance; applications of siliconizing.

7-2. **Brush Engineering.** G. O. Rowland. *Iron & Steel Engineer,* v. 21 ,Dec. '44, pp. 90-91.

Developments in industrial power brushes have aided greatly in meeting many production problems. The application of power brushing to modern production has advanced to an exact engineering status.

7-3. **Tests Concerning the Metal and the Preparation of Metal Surfaces for Porcelain Enameling.** W. W. Higgins. American Ceramic Society *Bulletin,* v. 23, Dec. 15, '44, pp. 473-475.

Résumé of information found in the ceramic literature concerning the metal and the preparation of metal surfaces for porcelain enameling. Brief résumés of those tests which seem to be favored in the literature as doing their respective "jobs."

7-4. **Review of Tests for Fineness and Consistency of Enamel Slips.** C. M. Andrews. American Ceramic Society *Bulletin,* v. 23, Dec. 15, '44, pp. 475-477.

Various methods for testing the fineness and consistency of enamel slips are reviewed. These methods are described and compared for their practicability in plant control.

7-5. **Review of the Test Methods Used to Determine Some of the Physical Characteristics of Porcelain Enamels When Applied to Iron and Steel.** F. A. Petersen. American Ceramic Society *Bulletin,* v. 23, Dec. 15, '44, pp. 477-480.

Tests to determine the resistance of an enamel coating to abrasion, impact, and acid attack and tests used to determine the bond between the enamel and metal are discussed.

7-6. **Determination of Thickness of Tin-Lead Alloy Coatings on Copper Wire.** J. W. Price. Society of Chemical Industry *Transactions,* v. 63, Oct. '44, p. 320.

The thickness of tin-lead alloy coatings or tin coatings on copper wire is determined by stripping a weighed sample of measured length in a solution containing nitric acid (d 1.42) 10 ml., urea 15 g., hydrogen peroxide (10-vol.) 10 ml., and water 80 ml. The loss of weight gives the weight of coating.

7-7. **Metal Finishing.** Adolph Bregman. *Iron Age,* v. 155, Jan. 4, '45, pp. 97-99, 180A-180C.

Metal finishing has played an unprecedented role in this war, and most of the progress made has been along the lines of replacement and substitutes for scarce or critical materials. The industry is more than pleased with the very excellent postwar prospects.

7-8. **New Vitreous Enameling Alloy Steel Developed.** *Steel Processing,* v. 30, Dec. '44, pp. 783-784.

Problem of successfully applying white or light pastel cover coat vitreous enamels directly to steel surfaces without the prior application of a base or ground coat enamel has been solved through development of a new vitreous enameling alloy steel known as Inland Ti-Namel steel.

7-9. **Blast Treatment of Metals for Cleaning and Peening.** Edwin Laird Cady. *Metals & Alloys,* v. 20, Dec. '44, pp. 1588-1592.

Reasons for use and the established applications of blast treatments. Provides practical hints for getting the most out of blast equipment and processes.

7-10. **1944 War-Time Metal Finishes.** Harry P. Coats. *Metal Progress,* v. 47, Jan. '45, pp. 102-104.

Metal finishes have been radically changed in nature since the war started, because of the scarcity of certain materials, and because of the desire to obtain dull finishes for products to be used in the combat zone. Lists the more important changes, and describes some of the recent electroplating baths.

7-11. **Shipyard Finds Wide Use for Metallizing Process.** *Steel,* v. 116, Jan. 15, '45, p. 101.

Spraying zinc, copper, brass, and steel speeds production by restoring equipment items to original condition, reclaiming spoiled work and generally cutting time on repairs.

7-12. **Coated Abrasives for Production Surface Finishing.** J. Albin. *Iron Age,* v. 155, Jan. 18, '45, pp. 50-56.

Increased accuracy and greater flexibility are being attained with coated abrasive belts placed on jobs that impose a surface finish requirement with stock removal on a low production cost basis.

7-13. **Finishing Aluminum with Paint Coatings.** Robert I. Wray. *Industrial Finishing,* v. 21, Jan. '45, pp. 66, 69-70, 72, 74, 76.

Primers and various types of protective and decorative coatings that are especially suited to different aluminum products—some coated before, others after fabrication.

7-14. **Product Finishes to Fit Your Postwar Plans.** S. P. Wilson. *Industrial Finishing,* v. 21, Jan. '45, pp. 78, 80, 82, 86, 88.

The protective and decorative coatings used on your postwar products have a great responsibility. Upon them will depend new public acceptance of your products at first and later—particularly later, when many other excellent articles will be offering stiff competition.

7-15. **Hot Aluminizing of Steel** *(La Technique Moderne,* v. 35, no. 21 and 22, Nov. 1 and 15, '43, p. 174). *Engineers' Digest* (American Edition), v. 2, Jan. '45, p. 20.

Aluminizing steel by a hot process by an annealing heat treatment of the steel before coating is done in an artificial atmosphere, the composition and effect of which vary according to the various functions to be carried out during the operation. While passing through this atmosphere the steel is heated and held at the annealing temperature, and is then plunged into a bath of molten aluminum after being cooled, prior to plunging, to a temperature strictly equal to that of the bath.

7-16. **Chromium-Nickel Steel.** W. H. J. Vernon, F. Wormwell, and T. J. Nurse. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 803-806.

Surface film on the 18-8 stainless alloy.

7-17. **Technical Developments of 1944.** Nathaniel Hall and G. B. Hogaboom. *Metal Finishing,* v. 43, Jan. '45, pp. 2-7, 20, 37-38.

Theoretical; anodizing; corrosion prevention; polishing; cleaning and degreasing; abrasive cleaning; pickling; coatings; electroforming; plating non-conductors; coloring; testing and control. 256 ref.

7-18. **Metallizing Non-Conductors V.** Samuel Wein. *Metal Finishing,* v. 43, Jan. '45, pp. 10-13.

Silver sulphide films; miscellaneous methods; tartrate method; formaldehyde methods; copper films; hydrazine methods; copper hydride; silver-copper alloys. 25 ref.

7-19. **Fine Finishing—Before and After.** *V.D.I. Zeitschrift,* v. 88, March 4, '44, pp. 121-124.

Excessive fine finishing represents an unnecessary expenditure in manpower and material. An attempt is made to establish (1) how the finishing must be performed, (2) the work period when this finishing should be accomplished, (3) and the limits of the indispensable finishing.

7-20. **Anodizing Racks.** *Aircraft Production,* v. 7, Jan. '45, p. 37.

Simple, employee-designed equipment saves time and material.

7-21. **Survey of Chemical Cleaning Practices for Spot Welding Aluminum Alloys.** F. M. Morris. *Welding Journal,* v. 24, Jan. '45, pp. 61s-64s.

Covers 30 aircraft companies from whom completed questionnaires were received. Vapor degreasers utilizing trichlorethylene as the solvent are used for degreas-

ing heavily soiled parts such as drop hammer parts and parts which are made in mechanical dies where lubricants are used. Seventeen different alkaline types of precleaners are used for removing light oil films, dust and identification ink markings from parts prior to immersion in the oxide remover. Primary function of the precleaners is to remove all foreign matter from the aluminum alloys and to obtain a "chemically" clean surface (one free from water-break) so that the oxide on the aluminum alloy will be uniformly attacked when immersed in the oxide remover. Nine acidic types of oxide removers are used on Alclad 24S-T while two alkaline types are used on bare 24S-T. Average number of spot welds, as reported by the various companies, which were obtained between electrode tip cleaning on the same metal thickness varied considerably for the same oxide remover and also for the different oxide removers.

7-22. **Wider Uses for Castings Through Surface Preparation.** J. H. Shoemaker and H. G. Webster. American Foundrymen's Association *Transactions*, v. 52, March '45, pp. 768-781.

Ferrous metal castings have some limitations which have been removed by the discovery of a new process for the preparation of the casting's surface. Describes actual commercial applications of the process to the following: Gray iron, special processed gray iron, electroplating tin to gray iron, unlike materials, brazing gray iron, special alloy, large castings, bronze to malleable to gray iron, and bronze and brass castings.

7-23. **Carbon Dioxide Extinguishing Systems Provide Safety in Degreasing.** *Steel*, v. 116, Jan. 29, '45, pp. 92, 94.

Units forming integral part of various automatic mass-production washing machines protect vital output.

7-24. **The Present Status of Electropolishing.** John S. Crout. *Metal Progress*, v. 47, Feb. '45, pp. 259-264.

Limitations; advantages; adherence of plate and enamel; economics.

7-25. **Lead-Alloy Coatings.** C. H. Hack, D. S. Kondrat and H. E. Zahn. *Metal Industry*, v. 66, Jan. 12, '45, pp. 18-19.

Wartime shortages in tin and zinc and a relative abundance of lead caused a quick conversion of many hot-dip operations to the use of a lead alloy much lower in tin than the conventional terne plate coating. Results have been so satisfactory from a fabrication, performance, and cost standpoint, that a wide postwar use may be predicted. 3 ref.

7-26. **Cleaning of Magnesium Welds.** Norman H. Simpson and Kenneth E. Dorcas. *Aero Digest*, v. 48, Jan. 15, '45, pp. 107, 212.

Consolidated Vultee method of cleaning: Immerse in 5 to 10% caustic soda at 150° F. for 5 min., rinse thoroughly in cold water, immerse in 20% chromic acid at 150° F. for 2 min.; rinse thoroughly in cold running water; dry by air blast.

7-27. **Precision Finishing Procedures for Instrument Parts.** *Die Casting,* v. 3, Feb. '45, pp. 60-62.

Anodic treatment and the application of synthetic organic enamels are involved in the surface finishing required on die cast aircraft instrument parts manufactured in this Bendix plant.

7-28. **Radium Paint.** *Steel,* v. 116, Feb. 19, '45, pp. 120, 122, 125.

More industrial applications seen as price drops from $5,000,000 to $1,000,000 per ounce.

7-29. **Metallizing Non-Conductors.** Samuel Wein. *Metal Finishing,* v. 43, Feb. '45, pp. 61-63, 76.

Gold films; lead sulphide films; nickel films; antimony films; cathode sputtering; metal spraying. 51 ref.

7-30. **Quality Control of Enameling Steels.** R. F. Bisbee. *Steel,* v. 116, Feb. 26, '45, pp. 82-83, 118, 120, 122, 124, 126, 128.

Suppliers of steels graded quarterly to reduce trouble in processing and expedite production. Classifications arrived at by evaluating actual performance, receiving department tests and laboratory reports. Vitamin A plays part.

7-31. **Porcelain Enamel on Steel Components in the Postwar Era.** G. H. McIntyre. *Steel Processing,* v. 31, Feb. '45, pp. 100-102.

Porcelain enamel; raw materials; acid resistance; use of enamel coatings; improved enameling steels.

7-32. **The Pickling of Steels, V.** Edward W. Mulcahy. *Sheet Metal Industries,* v. 21, Feb. '45, pp. 257-260, 261.

Bulk storage of acid.

7-33. **Safe Operation of Solvent Degreasers.** L. P. Litchfield. *Iron Age,* v. 155, March 1, '45, pp. 58-62.

In spite of bad practices in many plants it has been proved that degreasing can be efficient, economical and entirely safe, if a few simple rules are followed. The few instances of trouble have been traced to a lack of knowledge and understanding of the properties of the solvent, or the proper operation of the equipment, both phases of which the author covers in this article.

7-34. **Cataphoresis and Alundum Coatings.** E. S. Bidgood and George H. Kent. Electrochemical Society Preprint 87-4, April 16, '45, 9 pp.

Practical problems involved in applying alundum coatings to certain radio tube parts, in particular to heaters. Reclamation and the control of particle size of alundum discussed. Outline of the various operations and difficulties encountered in heater manufacture. Discussion of the use of cataphoresis in applying alundum coatings and experimental data conclude the paper.

7-35. **Barrel Finishing.** R. MacNair. *Metal Industry,* v. 66, Feb. 16, '45, pp. 98-100.

Deburring, smoothing, burnishing, special processes. Application of the tumbling process to various articles for which it is eminently suitable.

7-36. **Metallic Flake Pigments.** Stanmore V. Wilson. *Organic Finishing,* v. 6, Jan. '45, pp. 12-17.
Gold bronze. 4 ref.

7-37. **The Roller Coating Process.** Fred S. Bailey. *Organic Finishing,* v. 6, Jan. '45, pp. 20-23.
Types of coaters; spot coating machine; applications.

7-38. **Safe Spraying Practices, I.** *Organic Finishing,* v. 6, Jan. '45, pp. 25-27, 31-32.
Spray coating systems; pressure tank system; fixed pipe system; gun receptacle system; gravity feed system; precautions; storing, mixing and handling finishing materials; location of spraying operations; spray booths.

7-39. **Electrostatic Spraying and Detearing.** H. Forsberg. *Sheet Metal Industries,* v. 21, Feb. '45, pp. 298-300, 305-306, 310.
Complex metal parts painted automatically, economically, and with superior finish by spraying in an electrostatic field. Similar desirable results attend the electrostatic detearing of parts dipped in paint. (From *Iron Age*).

7-40. **Anodizing Aluminum.** Gilbert C. Close. *Industrial Finishing,* v. 11, Feb. '45, pp. 42, 44, 46, 48, 52-53.
Theory and application.

7-41. **The Chemistry of Polishing Wheels.** Henry R. Power. *Products Finishing,* v. 9, March '45, pp. 32-34.
Polisher can carry on his work with non-siliceous abrasives exactly as the grinding shop has been successful in displacing the sandstone wheels with modern grinding wheels carrying the more efficient and more hygienic electric furnace abrasives.

7-42. **Acid Fume Extraction.** Edward W. Mulcahy. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 61-64, 67.
Only effective way to extract acid fumes so as to neutralize their potential damaging effect to plant is to collect them at their source—the tank top. This can be accomplished either with a hood over the tank connected by trunking to a fan or with high velocity intake slots running the whole length of the tank side, at a height above the liquor level governed by the nature of the fumes and method of pickling.

7-43. **Metallizing Non-Conductors.** Samuel Wein. *Metal Finishing,* v. 43, March '45, pp. 103-106.
A metallic salt is dissolved in an "essential oil" and applied to the given surface such as glass, ceramic, mica, etc., and subjected to elevated temperature whereupon the metallic paint is reduced to metal and fused into the insulating material. A metal powder or a metallic salt is mixed with a suitable flux and an essential oil, applied to the given surface and subjected to an increase in temperature, fusing it to the given material. Metal powders mixed into suitable lacquer medium, applied to the given surface and fused thereto at elevated temperature. Materials forming a part of the porcelain used as a medium into which may be incorporated the metal salt or metal powder, and

formed into the given item, such as a vase, etc., and this is then "fired" in the kiln. 30 ref.

7-44. **Barrel Finishing.** R. MacNair. *Metal Industry,* v. 66, Feb. 23, '45, pp. 114-116.

A finish suitable for plating and metal coloring can be produced by the procedure detailed.

7-45. **Galvanizing.** W. H. Spowers, Jr. American Society of Naval Engineers *Journal,* v. 57, Feb. '45, pp. 78-90.

Some principles of zinc coating; pickling; water; flux wash; effect of alloy layers on bonding; galvanizing; formation of zinc dross; centrifugal galvanizing; investigation on use of sulphuric acid for pickling; method of procedure; results.

7-46. **Barrel Finishing.** R. MacNair. *Metal Industry,* v. 66, March 2, '45, pp. 134-135.

Describes the methods of dealing with domestic mincers, nails, chains, jewelry and pins, etc.

7-47. **Many Factors Govern Selection of Abrasives for Blast Cleaning.** D. C. Turnbull. *American Machinist,* v. 89, March 1, '45, pp. 98-101.

Whether to use sand, steel shot or grit depends upon material to be cleaned, equipment used and type of finish to be attained.

7-48. **Coatings for Fresh Water Tanks in Submarines.** Roy F. Perry. *Industrial Finishing,* v. 21, March, '45, pp. 62, 64, 66.

Brown metallic paint, clear phenolic varnish, cement wash, zinc dust, electrical treatment.

7-49. **A Film Is Born.** Paul O. Blackmore. *Industrial Finishing,* v. 21, March '45, pp. 40, 42, 44, 46, 48, 50, 52, 56, 60.

Drying by polymerization.

7-50. **Production Galvanizing of Ammunition Cases.** Allen T. Baldwin. *Iron Age,* v. 155, March 8, '45, pp. 68-70.

Use of hot galvanizing to provide a protective coating for steel ammunition cases made to hold 40-mm. anti-aircraft shells for the U. S. Navy.

7-51. **The Pickling of Steels—Part V.** Edward W. Mulcahy. *Sheet Metal Industries,* v. 21, March '45, pp. 437-442.

Lifting and agitating mechanism.

7-52. **Automatic Dipping Setup.** *Steel,* v. 116, March 12, '45, pp. 118, 168.

Millions of rivets and small aluminum alloy parts daily are given corrosion preventive treatment by Willow Run's "alrok" process, a combination of chemical reaction resulting in oxidized finish on parts and huge high production unit of conveyor, baskets and dipping tanks all in one.

7-53. **A Wartime Finish With Peacetime Applications.** R. H. Minton, Jr. *Industrial Gas,* v. 23, March '45, pp. 13, 31-32.

The various steps of the black oxide process can be followed by a flow diagram.

7-54. **Surface Film on 18-8 Stainless.** *Iron Age,* v. 155, March 15, '45, p. 57.

Enrichment of chromium as chromic oxide in the surface film and its dependence on the degree of polish are associated with surface flow during polishing.

7-55. **Some Observations on the Structure of Acid Resistant Vitreous Enamels for Chemical Plant.** G. E. Charlish and E. J. Heeley. *Foundry Trade Journal,* v. 75, Feb. 15, '45, pp. 127-130.

High frequency spark test and the detection of voids in enameled coatings.

7-56. **Vapor Phase Degreasing, II.** J. M. Payne. *Die Casting,* v. 3, March '45, pp. 67-68, 70.

Basic principles of vapor phase degreasing including the class type of solvents used and variations currently incorporated in machine design. Governing factors which must be considered in selecting the machine type best suited to die castings are discussed. Operating hints with a view to securing optimum solvent economy and elimination of health hazards are suggested.

7-57. **Fixtures Improve Output of Polishing and Buffing Machines.** A. H. Losey. *American Machinist,* v. 89, March 29, '45, pp. 115-118.

Machine tables accommodate six to eight fixtures. Examples of holding set-ups for production of various parts.

7-58. **Electrostatic Spraying and Detearing Process.** Sanford Narkey. *Modern Industrial Press,* v. 7, March '45, pp. 24, 26, 42.

Painting complex parts automatically, economically and with a superior finish.

7-59. **Conveyorized Equipment for Finishing Aircraft Parts.** R. R. Janssen and D. D. Williams. *Iron Age,* v. 155, April 5, '45, pp. 54-57.

Increased processing capacity for cleaning and finishing aluminum, magnesium and steel parts amounting to over 800,000 per week has been attained by a continuous overhead monorail conveyor with appreciable saving in space, manhours and material.

7-60. **New Magnesium Anodizing Process.** James C. Fuller. *Aluminum and Magnesium,* v. 1, March '45, pp. 20-21, 28-29, 43.

An anodizing method for coating magnesium alloys which produces a surface film that inhibits corrosion, resists abrasion and forms a tight, integral bond with paints. Explains the operation of the process and points out how revolutionary discovery was made.

7-61. **Symposium on Surface Finish.** *Machinery* (London), v. 66, March 15, '45, pp. 290-292.

The structure of sliding surfaces; surface finish in relation to friction and lubrication. 11 ref. (Institution of Mechanical Engineers).

7-62. **Chemistry of Surface Cleaning.** Ray Sanders. *Iron Age,* v. 155, April 12, '45, pp. 62-67.

Cleaning is a complex phenomenon involving in various combinations such actions as wetting, emulsification, saponification, colloidal activity, solvent power, pH, buffer action, total alkalinity and acidity and water conditioning. Much of the enormous amounts of time and labor expended in the removal of the common forms of dirt and paint can be cut by a knowledge of the basic factors involved in each surface cleaning job.

7-63. **Electrolytic Polishing of Stainless Steel and Other Metals.** Otto Zmeskal. *Metal Progress,* v. 47, April '45, pp. 729-736.

Various solutions reported to be satisfactory for the polishing of stainless steel, and discusses some of the variables involved in obtaining a bright surface from anodic action. The literature contains information on useful electrolytes for other metals, and this information is collected in a supplementary table. 114 ref.

7-64. **Rapid Finishing of Small Size Parts.** S. S. Pierce. *Die Casting,* v. 3, April '45, pp. 61-63.

Discussion of the factors involved in a balanced paint system and the application to high speed, low cost production finishing of small parts.

7-65. **Cleaning Aluminum Munition Components.** Vic Gruendler. *Die Casting,* v. 3, April '45, pp. 68-70.

Loading tests demonstrated one absolute "must" in the finishing of die cast aluminum munition components—cleanliness. How this important requirement was met.

7-66. **Surface Finish.** *Automobile Engineer,* v. 35, March '45, p. 119.

Surface to be measured; proposed wave length classification of surfaces; magnification and distortion of the graph.

7-67. **Eliminating the Old Steel Hot Plate Dryer, II.** Wallace G. Imhoff. *Products Finishing,* v. 9, April '45, pp. 40-42, 44, 46, 48, 50, 52, 54.

Liquid flux technique and how its use provides for the elimination of the old steel hot plate dryer in hot dip galvanizing.

7-68. **The Scope and Limitations of Radiant Heating in Drying Processes.** H. Silman. *Foundry Trade Journal,* v. 75, March 8, '45, pp. 195-198.

Methods which will find an important place in mass-production schemes. Tungsten filament bulbs; stoving of paints and enamels; influence of color; sources of radiation. 3 ref.

7-69. **Conditioning and Coating Small Parts for Aircraft.** James Crum. *Industrial Finishing,* v. 21, April '45, pp. 28-32.

Mass production setup designed to clean, dry and paint, efficiently and economically, the many small parts that go into the construction of Douglas aircraft.

7-70. **Surface Treatment for Metals.** F. A. Morral. *Wire and Wire Products,* v. 20, April '45, pp. 272-273, 276-277.

Cleaning and oxide removal; metal, diffusion, chemical, and organic coatings. Flame and induction hardening.

7-71. **Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings.** Gerald A. Lux and William Blum. *Journal of Research,* v. 34, April '45, pp. 295-324.

To determine whether the "finish" of steel prior to electroplating affects the protective value of the plated coatings, strips of cold-rolled steel were polished with wheels to which abrasives of different grain size were glued. The resultant finishes were measured with a profilometer. Polished specimens were plated with copper, nickel, and chromium of controlled thickness, and exposed. Extent of rusting observed at periodic inspections was expressed on a numerical scale, and the average results over a period such as one year were expressed as "percentage scores." Results with accelerated tests, such as the salt spray, hot water, feroxyl, and condensation tests, were not as reproducible and consistent as the atmospheric tests.

7-72. **Metal Cleaning: 1—Indirect Performance Tests.** Jay C. Harris. American Society for Testing Materials *Bulletin,* no. 133, March '45, pp. 23-28.

Reviews test methods to make them available for future use, to indicate the extent to which such tests are resorted to in defining qualities of cleaning compositions, and to develop constructive criticism. Cleaning processes are classified as these general types: Soak tank cleaning; mechanical tank or spray cleaning; electrolytic cleaning; solvent or vapor degreasing; emulsion degreasing. Available analytical methods and specifications outlined. Performance tests which are considered, and their general applicability given. 29 ref.

7-73. **Pickling in the Vitreous Enamelling Industry.** N. Swinden. *Foundry Trade Journal,* v. 75, April 5, '45, pp. 273-279.

Development of mass production and the chemistry and physics of pickling. 4 ref.

7-74. **Resin Coatings Baked by Induction Heating.** A. P. Mazzucchelli and R. E. Nicolson. *Iron Age,* v. 155, May 3, '45, pp. 46-50.

Baked phenolic coatings on pipe have demonstrated great resistance to corrosion in use. The application of induction heating to the continuous baking of resin coated pipes shows commercial practicability and many advantages over conventional baking methods. Other uses of induction heating for the curing of resin coatings on metal are discussed.

7-75. **The Composition of Abrasive Products.** Henry R. Power. *Modern Machine Shop,* v. 17, May '45, pp. 180, 182, 184, 186, 188, 190, 192, 194.

Method for critically examining the physical structure of abrasive compositions.

7-76. **Pumping Acid Solutions.** Edward W. Mulcahy. *Sheet Metal Industries,* v. 21, April '45, pp. 620-625, 630.

The rotary coil pickling machine; tube pickling machine; importance of fume extraction; the acid egg; the air lift; automatic air-pressure pump; jet pumps; centrifugal pumps; acid pipework.

7-77. **Trend in Aluminum Cleaning.** Jay C. Harris. *Aluminum & Magnesium,* v. 1, April '45, pp. 28-32.

Alkaline cleaning; neutral cleaning compositions; acid cleaning compositions; rinsing; patent literature; corrosion inhibitors; recent specifications; laboratory technic. 17 ref.

7-78. **Cleaning Metal With New Oxidizing-Reducing Process.** G. W. Birdsall. *Steel,* v. 116, May 7, '45, pp. 104-106, 130, 132, 134, 136.

Process removes colloidal graphite, facilitating subsequent porcelain enameling of deep drawn sheet steel parts; cleans out residual core sand from castings, permitting casting designs heretofore impracticable; makes possible good silver soldered or brazed joints, between cast iron and steel (or other metals) for the first time; prepares cast iron surfaces so they "tin" easily, thus extending use of high-lead babbitts in heavy duty bearings; employs a single electrically activated molten salt bath to handle many other difficult surface preparation jobs.

7-79. **Application and Selection of Organic Finishes.** C. R. E. Merkle. *Steel,* v. 116, May 7, '45, pp. 108-109, 176, 178, 185-186, 188, 190.

Selection of special finishes to meet the criteria of performance required in protecting and decorating sheet metal parts is simplified by the detailed analysis of factors affecting service functions presented, along with the most effective techniques for proper application of suitable finishes.

7-80. **Symposium—Cleaning Steel.** Nelson E. Cook, J. J. Duffy, J. I. Greenberger, and Lane Johnson. *Iron & Steel Engineer,* v. 22, April '45, pp. 53-60.

Cleaning steel for subsequent coatings; electrolytic cleaning lines; a modern strip pickling plant.

7-81. **Vapor Degreasing Aluminum Parts.** E. P. Troeger. *Products Finishing,* v. 9, May '45, pp. 32-34, 36, 38, 40.

Description of process and operation.

7-82. **Protective Treatments for Magnesium Alloys.** Jerome L. Bleiweis and A. J. Fusco. *Metals and Alloys,* v. 21, Feb. '45, pp. 417-434.

Provides a correlated review of virtually all the protective surface treatments developed to date, with data on the methods and materials used in each process; detailed and comparative information given on the techniques and applicabilities of the more common chemical surface treatments and on the plating and painting of these alloys; how magnesium corrodes and corrosion control by composition modification. 30 ref.

7-83. **Symposium on Surface Finish.** *Machinery* (London), v. 66, March 22, '45, pp. 318-321, March 29, '45, pp. 345-348.

Surface finish on production methods, by W. E. R.

Clay. Results of modern practice, by F. Nourse. Principles and methods of surface measurements, by R. E. Reason.

7-84. **Symposium on Surface Finish: Continuity in the Production of Specified Surface Finish.** E. Swain. *Engineering,* v. 159, March 30, '45, pp. 258-260.

If a ground or honed finish is to be improved, the matter resolves itself into moderate finish with accuracy and speed of operation, as against fine finish, with slow operation coupled with the danger of generating excessive temperature, and its consequences.

7-85. **Protection of Magnesium Alloys by New Anodizing Process.** N. H. Simpson and P. R. Cutter. *Aviation,* v. 44, May '45, pp. 150-153.

Aircraft weight savings are held feasible through expanded use of light weight metal made possible by a protective coating which not only gives good corrosion resistance but withstands rough handling and service.

7-86. **Symposium on Surface Finish.** W. Ker Wilson. *Engineering,* v. 159, April 6, '45, pp. 277-280.

Effect on fatigue strength.

7-87. **Surface Finish.** *Automobile Engineer,* v. 35, April '45, pp. 141-146.

Survey of the practical aspects of present-day knowledge.

7-88. **Cleaning Forgings for Magnaflux Inspection.** E. H. Johnston. *Steel,* v. 116, May 21, '45, p. 111.

Cleaning method which provides a surface free of scale, and one which has a clear, bright surface upon which the red or black Magnaflux powders stand clearly in relief.

7-89. **Evaluation of Metal Decorating Coatings.** W. F. Holland. *Organic Finishing,* v. 6, May '45, pp. 9-10, 12-16.

Evaluation coatings; application; testing; processing; chemical tests; trends. 2 ref.

7-90. **Luminous and Fluorescent Paints.** *Organic Finishing,* v. 6, May '45, pp. 19-21, 24.

Letter Circular 703, National Bureau of Standards. General information regarding luminous and fluorescent paints.

7-91. **Electrostatic Spraying and Detearing.** Sanford Markey. *Organic Finishing,* v. 6, May '45, pp. 37-41.

Electrostatic spraying and detearing allow faster, better and more economical finishing. Discusses the process in general.

7-92. **How to Prevent Corrosion Under Paint.** Ray Sanders. *Corrosion and Material Protection,* v. 2, May '45, pp. 15-16, 24.

Solution to the problem of corrosion beneath applied coatings consists in the application of a phosphatizing treatment after cleaning and immediately prior to painting.

7-93. **How to Select a Rust Preventive.** J. R. C. Boyer. *Corrosion and Material Protection,* v. 2, May '45, pp. 7-9.

Oils and greases intended as rust-protective coatings must be inhibited. Selection of the proper type of preservative begins with the inhibitor. Theory behind inhibition of oils and greases. To sum up the objects of a treatment, whether inhibitive or special-purpose additive, the purposes are: To increase wetting speed of the finished product; to inhibit oxidation of the film which in itself would increase the danger of corrosion; to increase film strength of the product; to increase adhesion characteristics; to enhance lubricating qualities where required.

7-94. **Lead Coated Steels Appraised.** *Iron Age,* v. 155, May 24, '45, pp. 56-57.

Virtues and limitations of lead coatings on steel, and the possibilities of substituting them for terne and galvanized materials. An efficient method of stripping lead and lead-alloy coatings.

7-95. **Polishing Jacks Can Be Converted to Efficient Belt Grinders.** Rupert Le Grand. *American Machinist,* v. 89, May 24, '45, pp. 103-105.

Inexpensive accessories permit better and faster work.

7-96. **Spark-Proofing Powder Tanks.** D. Saponara. *Better Enameling,* v. 16, May '45, pp. 13-14.

With production metallizing, only one-fifth the former amount of bronze is required in the manufacture of powder tanks for 14-in. Naval guns. Other wartime advantages include release of critical machine tool facilities.

7-97. **Black Finishes for Steel.** H. Silman. Electrodepositors' Technical Society *Journal.* Preprint, v. 20, 1945, pp. 77-92.

Requirements and types of black finishes. Temper colors; caustic alkali-nitrate processes; temperature; two-tank process; additives; characteristics of black oxide coatings; phosphate coatings; Coslett's process; Coslett's zinc solution; accelerators; method of operation; effect of temperature; cleaning; impregnation; black nickel plating; molybdenum-nickel deposits. 5 ref.

7-98. **Large-Volume Degreasing.** *Western Metals,* v. 3, May '45, pp. 24-27.

Automatic operation made fire-safe by carbon dioxide.

7-99. **Blackened Stainless Steels.** Perry B. Strassburger. *Metals and Alloys,* v. 21, May '45, pp. 1307-1312.

Strong, tough and black metal that is at the same time corrosion resistant throughout its section. Nature and characteristics of the material and outlines present and potential applications.

7-100. **Eliminating the Old Steel Hot Plate Dryer, 3.** Wallace G. Imhoff. *Products Finishing,* v. 9, June '45, pp. 48-50, 52, 54, 56.

Function of the liquid flux technique in hot-dip galvanizing is discussed in detail, including equipment required.

7-101. **Some Observations on the Structure of Acid-Resistant Vitreous Enamels for Chemical Plant.** G. E. Charlish and E. J. Heeley. *Foundry Trade Journal,* v. 75, April 12, '45, pp. 303-305.

A standard test needed; enamel capable of replacing rubber; vigorous research work; improved design needed; differential expansion; instructing the foundries.

7-102. **Analysis of Hydrofluoric-Nitric Acid Stainless Steel Pickling Bath.** William E. McKee and William F. Hamilton. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, May '45, pp. 310-312.

Economical and efficient operation of the hydrofluoric-nitric acid stainless steel pickling bath requires control by chemical analysis. Rapid quantitative analytical procedures are presented for the analysis of the bath. They include the determination of total acidity, iron, fluoride, and nitrate. 9 ref.

7-103. **Anode Polishing.** F. C. Mathers and R. E. Ricks. Indiana Academy of Sciences *Proceedings,* v. 53, 1943, pp. 130-133. British Aluminum Company *Light Metals Bulletin,* v. 9, May 18, '45, pp. 134-135.

7-104. **Specifying Rust Preventives.** J. Albin. *Iron Age,* v. 155, June 7, '45, pp. 52-59.

Preliminary step to correlate and classify petroleum-base rust prevention products suitable for general industrial purposes. Tables compiled to help in the selection of the product appropriate for the protection of the part or machine under specific conditions.

7-105. **Electrostatic Spraying of Porcelain Enamels.** James B. Willis. *Finish,* v. 2, June '45, pp. 21-24, 50.

Detailed report of an investigation of a new method for enamel application.

7-106. **Surface Finishes for Aluminum.** W. L. Maucher and C. B. Gleason. *General Electric Review,* v. 48, June '45, pp. 26-30.

Features, functions, and effects of electrical and chemical processes for treating surfaces of aluminum and its alloys.

7-107. **New Tool Treatment Increases Productivity.** *Production Equipment and Management,* v. 15, June '45, pp. 71-72.

After treatment with "Tough-Ite" process, cutting tools are credited with 100% greater productivity between grinds on stainless steel. Substantial savings are indicated on turning operations when processing non-ferrous metals.

7-108. **Flux Reaction During Hot-Dip Galvanizing.** H. Boblik, F. Gotzl, and R. Kukaczka. *Metall Wirtschaft,* v. 22, Oct. 20, '43, pp. 463-466.

7-109. **Action of Pickling Acid Admixtures.** K. Wickert. *Metall Wirtschaft,* v. 22, Oct. 20, '43, pp. 475-480.

7-110. **Phosphate Surface Treatment and Its Scientific Basis.** W. Machu. *Metall Wirtschaft,* v. 22, Oct. 20, '43, pp. 481-487.

7-111. **The Formation of Metal-Sprayed Deposits.** W. E. Ballard. *Proceedings* of the Physical Society, v. 57, March 1, '45, pp. 67-83.

Difficulties of research on the process examined, these difficulties being increased by the rapidity of the cycle of events in the process of wire spraying. Some difficulties have been overcome by the use of the high-speed cine camera, which has indicated that the spray of metal is rapidly pulsating and that a reaction of the deposited agglomerates of particles takes place on the surface. A theory is put forward to show that surface tension plays a considerable role both in the pulsation of the spray and in the ultimate structure of the coating. Some indications are given that the amount of metal sprayed in unit time is controlled by well-known physical laws, and an empirical formula for speed of working is given. 14 ref.

7-112. **Symposium on Surface Finish.** *Machinery* (London), v. 66, May 10, '45, pp. 514-515.

Locomotive practice, by F. C. Johansen.

7-113. **Lifting and Agitating Mechanism, V.** Edward W. Mulcahy. *Sheet Metal Industries,* v. 21, March '45, pp. 437-442.

Lifting mechanism; pivoting jib crane; the radial pickling machine; acid plungers; reciprocating-conveyor machine; chain agitation for tubes, rods, etc.; coil-pickling machine.

7-114. **Die Castings Can Be Colorful.** *Die Casting,* v. 3, May '45, pp. 42-43, 60.

Beginning of a series showing how die castings can be finished. There is virtually no limitation in color or variety of finishes especially developed for this field.

7-115. **Finishing Telephone Set Housings.** *Die Casting,* v. 3, May '45, pp. 62-63, 65, 80.

Familiar satin-black finish of zinc alloy die cast telephone housings is produced on a mass production basis. Here's how it is done.

7-116. **Vapor Phase Degreasing. Part III.** J. M. Payne. *Die Casting,* v. 3, May '45, pp. 73-74, 76.

Basic principles of vapor phase degreasing, including the class type of solvents used and variations currently incorporated in machine design. Factors which must be considered in selecting the machine type best suited to die castings discussed. Operating hints with a view to securing optimum solvent economy and elimination of health hazards suggested.

7-117. **Fungicide Coatings in War and Peace.** Fred Simmons. *Industrial Finishing,* v. 21, May '45, pp. 72, 74, 79.

Early objections to fungicide coatings by workmen; lacquer and varnish type materials developed; when and how to apply fungus-resistant coatings.

7-118. **Heating Pickling Solutions and Waste Acid Treatment Plant, VII.** Edward Mulcahy. *Sheet Metal Industries,* v. 21, May '45, pp. 799-805, 809.

Heating pickling solutions; waste acid treatment plant.

7-119. **Corrosion Preventives.** J. R. C. Boyer. *Steel,* v. 116, June 11, '45, pp. 128-130, 132, 176, 178.

Wide variety of materials available for preventing the deterioration of metal surfaces. Types of coatings, including neutralizers and inhibitors, and their functions and applications discussed.

7-120. **Galvanizing.** W. H. Spowers. *Wire and Wire Products,* v. 20, June '45, pp. 420, 424-427, 451-453.

Principles of zinc coating; pickling; water; flux wash; effect of alloy layers on bonding; galvanizing; formation of zinc dross; centrifugal galvanizing; investigation on use of sulphuric acid for pickling; method of procedure; results.

7-121. **Developments in Wire and Cable Coatings.** Carl Bauer. *Wire and Wire Products,* v. 20, June '45, pp. 428-430.

War developments have established requirements for wire and cable with low temperature flexibility, high heat stability, moisture and fungi resistance, oil and gasoline resistance, together with excellent electrical characteristics. A discussion of coatings to meet such requirements presented.

7-122. **Plastic Coatings Protect Carbide Tipped Tools.** Bernard Gould. *Iron Age,* v. 155, June 14, '45, pp. 66-67.

In addition to protection against corrosion, plastic dip coatings are finding use as a means of cushioning tools and machined parts from chipping and abrasion.

7-123. **Skin Heating.** *Aircraft Production,* v. 7, May '45, pp. 207-209.

Improving surface finish by thermal expansion of light-alloy skin-plating before riveting.

7-124. **Symposium on Surface Finish.** *Machinery* (London), v. 66, April 19, '45, pp. 427-429.

Rational specification of surface finish; requirements in surface finish.

7-125. **Black Finishes for Steel.** H. Silman. *Metal Industry,* v. 66, May 25, '45, pp. 330-332.

Prevention of rusting of steel is a problem that has only been partially solved. Of the methods available, the application of a black finish by oxide or phosphate coatings is described. (Electro-depositors' Technical Society.)

7-126. **Ethyl Cellulose Plastic Coatings.** R. L. Geehr. *Machine Tool Blue Book,* v. 41, June '45, pp. 275-276, 278, 280, 282.

Used as a protective coating on such precision parts as gears, bearing shells, motor splines, engine rods, shafts and many other parts. Protects highly finished surfaces with a skin-like film approximately 1/16 in. thick, which in its application has excluded all air from

the highly finished surface. At the same time, the compound itself exudes a light film of oil to the surface of the part, affording easy removal and clean stripping of the coating at the time the part is to be used.

7-127. **Symposium on Surface Finish.** *Machinery* (London), v. 66, April 26, '45, pp. 457-458.

Continuity in the production of specified surface finish.

7-128. **Electrolytic Polishing of Lead Bronzes, Zinc and Magnesium Micrographic Applications.** P. A. Jacquet. Les Laboratoires L.M.T., Notice VI de la Societe "Le Materiel Telephonique," 1942, 12 pp. British Non-Ferrous Metals Research Association *Bulletin,* no. 191, May '45, p. 118.

7-129. **Introduction to the Study and Use of Electrolytic Polishing of Metals and Alloys.** P. A. Jacquet. *Metaux,* v. 18, Jan. '43, pp. 1-21. British Non-Ferrous Metals Research Association *Bulletin,* no. 191, May '45, p. 119.

7-130. **Metal Cleaning: 1—Indirect Performance Tests.** Jay C. Harris. *Metal Finishing,* v. 43, June '45, pp. 238-241, 263.

Information regarding suggested or currently used evaluation tests in readily available form. Information given in this paper should not be considered as a recommendation, since no specifications have as yet been developed. 28 ref.

7-131. **Black Anodizing Copper and Brass.** John D. McLean and C. B. F. Young. *Metal Finishing,* v. 43, June '45, pp. 247-248.

Deep black, which is adherent to copper and copper alloys, can be produced by treating the object to be colored as an anode in a strong alkali solution.

7-132. **Die Castings Can Be Colorful.** *Die Casting,* v. 3, June '45, pp. 38-39, 41.

Die castings for sales appeal and resistance to corrosion.

7-133. **Organic Finishes for Die Castings.** Gustave Klinkenstein. *Die Casting,* v. 3, June '45, pp. 66, 68.

Organic finishes developed for the die casting alloys have greatly expanded the scope of product finishing. Summary of the characteristics of these coatings.

7-134. **Drying Large and Small Work in Versatile Infra-Red Installation.** H. L. Boyden. *Industrial Heating,* v. 12, June '45, pp. 1002, 1004.

Unusual features which make it more versatile than the usual set-up.

7-135. **Facts and Figures on Zinc Spraying.** *Steel,* v. 116, June 25, '45, p. 132.

Thickness of the sprayed zinc determines the corrosion resistant potential of the surface so protected. Cost studies.

7-136. **Evaluating Surface Finishes.** *Steel,* v. 116, June 25, '45, pp. 142, 144, 176.

Accurate and rapid method of determining type and

quality of surface finish of metals utilizes clear plastic film which "flows" over surfaces. Replica then is stripped and surface examined by passing it through narrow beam of light to register irregularities on photo-electric cell. 2 ref.

7-137. **Infra-Red in Industry.** William Miskella. *Sheet Metal Worker,* v. 36, June '45, pp. 45-46, 54.

Paints which have been baked for one hour in a convection oven are now processed in an infra-red oven in 6 min. Instead of an oil bath for expanding bearings for assembly on shafts, they may be placed under the infra-red heat for a few minutes and will be expanded sufficiently to slip over the shaft in question. They are used for drying, processing, and heating in many ways, in temperatures from room to 600° F.

7-138. **Surface Preparation of Structural Steel—a Review.** George Diehlman. *Paint and Varnish Production Manager,* v. 25, June '45, pp. 152-154, 156, 158-160.

Review of the work published in the *Official Digest,* in papers presented at Federation meetings, and articles in other publications.

7-139. **Crosley's Setups for Painting War Products.** Frank B. Knight. *Industrial Finishing,* v. 21, June '45, pp. 38-42, 44, 46, 48, 50.

Conveyorized spray painting, dip coating, electrochemical treatment, fungus-resistant lacquering, silk-screen stenciling, chemical dyeing and Iridite treatment, for protectively coating war products.

7-140. **Luminous Paint.** Arthur H. Jackson. *Industrial Finishing,* v. 21, June '45, pp. 52, 54.

Notes on how to use luminous paint properly, preparation of surface to receive it, how to apply it, and what precautions to take to insure satisfaction.

7-141. **Bake Finishing Setup for New Motor Parts.** A. G. Trivison. *Industrial Finishing,* v. 21, June '45, pp. 56-61, 64, 66.

Well planned conveyorized setup for cleaning, dip coating and oven baking the parts of small motors and transformers; plus a parallel arrangement of equipment for impregnating electrical coils and baking impregnated coatings afterward.

7-142. **Conveyorized Setup for Painting M-38 Bombs.** G. L. Hehl. *Industrial Finishing,* v. 21, June '45, pp. 80, 82, 84, 86.

Shows how perfectly a well planned conveyorized setup takes care of cleaning all metal surfaces, applying protective coatings and quickly drying the paint on a two-coat production job.

7-143. **Anodic Treatment of Aluminum Gives Corrosion Resistance.** W. L. Maucher. *American Machinist,* v. 89, June 21, '45, pp. 105-107.

Effects of electrical treatment of aluminum increase corrosion resistance and, in some cases, surface hardness. Paint adhesion and appearance improved.

7-144. **Electrostatic Spraying of Porcelain Enamels, II.** James B. Willis. *Finish,* v. 2, July '45, pp. 21-24, 46.

Detailed report on an investigation of a new method of enamel application.

7-145. **Ford's Method of Preparing, Applying and Testing Synthetic Resin Enamels.** *Steel,* v. 117, July 2, '45, pp. 100, 151-152.

Enamels are for use on universal carriers, light armored cars, jeeps, trucks and other vehicles. Methods of paint application are controlled under Army Specifications, .60-0-1B, Painting Procedures. Ford has deviated from the specifications only by utilizing infrared ray lamps for drying instead of steam ovens, thus shortening drying time. By this method costs have been reduced.

7-146. **Electrolytic Polishing.** J. S. Crout. *Metal Industry,* v. 66, June 8, '45, pp. 357-359.

Decorative finishing; de-burring; de-scaling; machining. (From *Metal Progress.*)

7-147. **Black Finishes for Steel.** H. Silman. *Metal Industry,* v. 66, June 8, '45, pp. 362-363.

Operation of the phosphating process and the protection of the coating. Black nickel and molybdenum-nickel electrodeposits. 4 ref.

7-148. **Chromating Solutions.** G. E. Coates. *Metal Industry,* v. 66, June 8, '45, p. 364.

Analytical determination of dichromate and sulphate. 1 ref.

7-149. **Chemical Surface Treatments for Gear Teeth.** *Automotive Industries,* v. 93, July 1, '45, pp. 40, 102, 104, 106, 108, 110, 112.

Tests to determine the effectiveness of various chemical surface treatments as means to prevent or delay failure of gears by scuffing. Treatments to be investigated might include phosphate treatments of various types, a caustic soda-sulphur treatment, electrolytic tin plating, an anodic deposition of colloidal graphite, a nitric acid etch treatment.

7-150. **A Discussion of Pickling and Cleaning of Iron in Fused Salt Baths.** *Enamelist,* v. 22, June '45, pp. 8-10, 48-49.

Kolene and Tainton processes.

7-151. **The Successful Finishing of Electrically Insulated Wire and Cable.** Ralph C. Ellams. *Wire & Wire Products,* v. 20, July '45, pp. 485-489, 520-523.

Handling of the protective coating prior to application; mechanics of application; production problems and their solution.

7-152. **Sprayed-Metal Jig Members Speed Up Jet Plane Production.** Charles O. Herb. *Machinery,* v. 51, July '45, pp. 148-153.

Applies metal spraying to save time in constructing nest blocks for major jigs and fixtures.

7-153. **Die Castings Can Be Colorful, III.** *Die Casting,* v. 3, July '45, pp. 42-43.

Variety of colors, surface textures and protective properties available for die cast metals.

7-154. **Spray Setup of Polishing Wheels and Buffs.** *Iron Age,* v. 156, July 12, '45, pp. 55, 130.

Spraying of a mixture of cold glue and abrasive on buffs and polishing wheels to keep them cutting continuously is showing substantial production economies.

7-155. **Electropolishing of Stainless Steels.** *Iron Age,* v. 156, July 12, '45, pp. 64-66, 130.

Rustless Iron and Steel Corp. is promoting on a license-free basis a citric-sulphuric acid process described herewith, and stands ready to loan bench type apparatus for trial processing of postwar goods made of stainless steel.

7-156. **Chemical De-Scaling of a Modern Steam Generator.** M. E. Brines. *Power Plant Engineering,* v. 49, July '45, pp. 90-92, 99.

Details of two chemical treatments for cleaning a two-drum, D-type, 150,000-lb. per hr., 425-psi., 735° F. unit. Unit typical of many now operating; treatments illustrate progress in treating techniques; single tube experiments, made first, prove value of preliminary data before making actual treatment.

7-157. **Corrosion Proofed Metals.** *Plastics,* v. 3, July '45, pp. 98, 100, 140.

Extremely resistant to abrasion, shock, acid and base solutions, new plastics surface coating also withstands heat, applies easily.

7-158. **Electrostatic Spraying Applied to Porcelain Enameling.** James B. Willis. *Ceramic Industry,* v. 45, July '45, pp. 58, 60, 62-65.

Position of spray gun is of primary importance. Success of spraying operation depends largely upon preparation of enamel. Amount of over-spray may be reduced to as little as 15 or 20%.

7-159. **Electrolytic Polishing of Stainless Steel and Other Metals.** Otto Zmeskal. *Metal Finishing,* v. 43, July '45, pp. 280-286.

Paper primarily presents various solutions reported to be satisfactory for the polishing of stainless steel, and discusses some of the variables involved in obtaining a bright surface from anodic action. The literature contains information on useful electrolytes for other metals, and this information is collected in a supplementary table. 114 ref. (From *Metal Progress.*)

7-160. **Final Operations.—I.** G. Schlesinger. *Aircraft Production,* v. 7, June '45, pp. 266-273.

Requirements to obtain good quality surface finish; methods of measurement; a survey of finishing processes.

7-161. **The "Topograph" Surface-Finish Measuring Instrument.** *Engineering,* v. 159, June 1, '45, pp. 427-428.

Operates on a simple pneumatic principle and gives a pen record 10 in. long by 5 in. wide, on paper, in 3 min., the record being an enlarged profile of the sur-

face irregularities along a selected straight line. On the graph traced by the pen the heights of the surface irregularities are directly ascertained in micro-inches by multiplication by the particular conversion factor for which the instrument is set. Irregularities of the order of 2 micro-inches are readily detected when the setting is for a magnification of 20,000 to 1.

7-162. **Surface Chemistry Declares War on Dirt.** Ray Sanders. *Products Finishing,* v. 9, July '45, pp. 54, 58, 60, 62, 64.

Wetting action; emulsifying action; saponifying action; colloidal action; solvent action; pH and cleaning; buffer index; total alkalinity or acidity; water conditioning.

7-163. **Considerations in the Use of Paint For Metals Protection.** J. H. Finley. *Corrosion & Material Protection,* v. 2, June '45, p. 18.

Metal to be protected must be properly cleaned and prepared. Selection of finish coat is dependent entirely upon the conditions existing.

7-164. **Metallizing—Modern Production Tool.** William M. Flashenberg. *Tool Engineer,* v. 14, June '45, pp. 46-47.

Many metals can be "spray-coated" to provide hard surface or to reclaim worn or undersize parts.

7-165. **Metallizing—a Production Process.** L. E. Kunkler. *Metals & Alloys,* v. 21, June '45, pp. 1648-1649.

Few engineers realize the extent to which sprayed-on metals are employed as elements in original design and production, as distinct from repair and maintenance uses and the promising field for metallizing as a production design tool. Describes typical successful applications, features the materials engineering aspects and the special service characteristics frequently provided by metallized parts.

7-166. **Chemical Treatment of Aluminum Improves Paint Adherence.** C. B. Gleason. *American Machinist,* v. 89, July 19, '45, pp. 113-114.

Providing a bond for painted finishes is the one principal function of chemical treatment of aluminum. Corrosion resistance increase is considered a minor secondary effect.

7-167. **Chemical Surface Treatment for Gear Teeth.** *Automotive Industries,* v. 93, July 1, '45, pp. 40, 102, 104, 106, 108, 110, 112.

Series of tests to determine the effectiveness of various chemical surface treatments as means to prevent or delay failure of gears by scuffing; results are considered sufficiently promising to warrant experimental application of one class of the chemical treatments investigated (phosphating) in cases where scuffing is likely to occur. Treatments applied to the gears were essentially the same as those applied in this country to piston rings and certain other parts to prevent scoring; abstract of a report on the test.

7-168. **Works Practice in the Pickling of Steel.** E. Marks. *Sheet Metal Industries,* v. 22, July '45, pp. 1179-1183.

Inhibitors; rusting after pickling; mixed acids.

7-169. **The Finishing of Light Alloys. Part VII.** H. Silman. *Sheet Metal Industries,* v. 22, July '45, pp. 1211-1218.

Aluminum; etched finishes; anodizing; chromic acid process; operating conditions; plant limitations of the process; sulphuric acid processes operation; maintenance of bath; properties of anodic films; impurities in the bath; dyeing of anodic films; dyes; multi-color effects; photographic processes; pigment impregnation; sealing of anodic films. 14 ref.

7-170. **Electrolytic Methods of Polishing Metals, Part VIII—The Precious Metals.** S. Wernick. *Sheet Metal Industries,* v. 22, July '45, pp. 1221-1222, 1229-1233.

Platinum and palladium; platinum plating; palladium plating. 11 ref.

7-171. **Trick Finishes.** S. P. Wilson. *Industrial Finishing,* v. 21, July '45, pp. 26-28, 30.

Novel and decorative finishes that can be utilized to give strikingly attractive effects to a number of postwar civilian products.

7-172. **Cleaning of Metals for Production Painting.** Ray Sanders. *Industrial Finishing,* v. 21, July '45, pp. 32, 34, 36, 38.

When the surface is coated with foreign matter adhesion of paint cannot take place. It is necessary therefore to remove grease, oil and dirt in order that a smooth, tightly adherent paint job can be obtained.

7-173. **Quality Control Through Production Records.** William W. Loman. *Industrial Finishing,* v. 21, July '45, pp. 44, 46, 48.

System to provide an accurate record of the quantity and kind of parts that are put through on each order, the strength and temperature of metal cleaning solutions used, all facts about paint materials applied; oven baking time and temperatures and the names of workers who were in charge of operations.

7-174. **Conveyorized Finishing.** E. H. Trettin. *Industrial Finishing,* v. 21, July '45, pp. 50-52, 54, 56.

Several recommendations and suggestions to manufacturers who plan to investigate or install conveyorized finishing.

7-175. **Cleaning, Painting, Drying Setup for Steel Cabinets.** Ralph F. Lane. *Industrial Finishing,* v. 21, July '45, pp. 60-64, 68-69, 72.

How a conveyorized setup for surface cleaning, painting, and drying steel cabinets was planned, engineered and put in, what operating schedules were developed, the number of employees needed, speed of conveyor, and a peek at the estimated finishing costs.

7-176. **Coating Armored Electric Cables for Ships.** Henry Novak. *Industrial Finishing,* v. 21, July '45, pp. 98, 100, 102.

Hundreds of thousands of feet of cable primed with the simple dipping equipment described. Same idea could be adapted for various other jobs of coating or treating cable, wire, or rope.

7-177. **Jungle Tests for Metal Finishes.** Burr Price. *Products Finishing,* v. 9, July '45, pp. 32-34, 36, 38.

Destructive effect of mildew and fungus attack on troop equipment. Chemical treatments have been perfected for use on the clothing of the boys to make them resistant to the attacks of disease-carrying mites. Development of materials which will serve as moisture barriers.

7-178. **Aluminum Coating for Unplated Can Stock.** W. B. Roberts. *Modern Packaging,* v. 18, July '45, pp. 122-125.

To improve the corrosion resistance of the blackplate and bonderized stock, can manufacturers have turned to a proved method of protection involving the use of aluminum pigmented coatings. Aluminum enamels used for coatings of this type consist of a mixture of extremely fine aluminum pigment and a varnish liquid similar in most respects to that employed with other colors.

7-179. **The Successful Finishing of Electrically Insulated Wire and Cable. III.** Ralph C. Ellams. *Wire & Wire Products,* v. 20, Aug. '45, pp. 569-572.

Production problems and their solution. Incompatibility in reservoir or on wire; poor coating pick-up; excessive coating pick-up; irregular coating; sleeving; sticking on sheaves; sticking on adjacent strands; flattening of finish on sheaves; blistering; pinholing; coating deformation on reeling.

7-180. **Cleaning Aluminum.** C. W. Smith. *Modern Metals,* v. 1, Aug. '45, pp. 16-17.

Surface contaminates and oxides must be removed from aluminum products before spot welding or paint-bond treatments; describes the steps necessary in the cleaning process.

7-181. **Papers on Surface Finish.** *Engineers' Digest* (American Edition), v. 2, July '45, pp. 341-344.

Structure of sliding surfaces; short review of surface finish in relation to friction and lubrication; some principles and methods of surface measurement; results of modern practice.

7-182. **Metallizing Magnesium.** Roy Fellom. *Light Metal Age,* v. 3, July '45, pp. 11, 33.

Relatively new processing application for magnesium described and possible applications which may not prove out under testing.

7-183. **Surface Comparison.** *Western Machinery & Steel World,* v. 36, July '45, p. 311.

New process reproduces faithfully specified machine finishes. It is a refinement on electro-forming methods which permit plating with hard metals, and will reproduce exact facsimiles of surfaces down to the millionth of an inch.

7-184. **Chromizing Processes.** D. W. Rudorff. *Metallurgia,* v. 32, June '45, pp. 59-62.

Process of diffusing chromium into the metallic surface depends for its success on the effective and uniform supply of chromium to the surface to be treated and also upon the maintenance of conditions favorable for diffusion in sufficient depth. The use of granular chromium or ferrochrome and of liquid chromium are briefly referred to but particular attention is directed to the use of the gaseous phase by the employment of chromous chloride.

7-185. **Wearing Qualities of Gold Deposits.** George B. Hogaboom. *Metal Finishing,* v. 43, Aug. '45, pp. 329-330.

Good lacquer superior to heavier gold deposits.

7-186. **Analysis of Hydrofluoric-Nitric Acid Stainless Steel Pickling Bath.** William E. McKee and William F. Hamilton. *Metal Finishing,* v. 43, Aug. '45, pp. 332-333, 339.

Economical and efficient operation of the hydrofluoric-nitric acid stainless steel pickling bath requires control by chemical analysis. In this paper rapid quantitative analytical procedures are presented for the analysis of the bath. 9 ref.

7-187. **Sandblasting Removes Sharp Angles From Aluminum Alloy Spar Caps.** J. B. Adams. *American Machinist,* v. 89, Aug. 16, '45, pp. 111-112.

Seven adjustable nozzles direct sand to all of the surface parts of extrusions. Special handling equipment avoids marring of cap.

7-188. **Automatic Spray Painting.** R. H. Wallace. *Monthly Review,* v. 32, Aug. '45, pp. 781-782, 843.

Application; savings in labor; savings in material; savings in floor space; cleanliness; cost control; products; construction.

7-189. **Production-Line Finishing.** *Steel,* v. 117, Aug. 27, '45, pp. 110, 112.

Methods and fixtures which were used for coating mortar shell cases in quantity suggest ready adaptation to other finishing problems.

7-190. **Short Cycle Anodizing.** *Steel,* v. 117, Aug. 27, '45, pp. 114, 116, 118.

Uses less power and chromic acid, in addition to shortening time for operation to 20 min.

7-191. **Continuous Pickler for Coiled Material.** A. S. Hellstrom. *Iron & Steel Engineer,* v. 22, Aug. '45, pp. 59-61.

New design, developed by Greer Steel Co. and licensed for manufacture. Handles wide and narrow strip, rod, or wire. Experience has shown a fine operating record with good economy.

7-192. **Metals, Finishes, and Finishing Processes.** Edward Engel. *Iron Age,* v. 156, Sept. 6, '45, pp. 70-79.

Physical cleaning procedure; metal preparation equipment; typical preparation procedures; preparation of specific metals; pickling; tumbling, sand blasting.

7-193. **Low-Cost Protective Coatings for Tools and Gages.** J. V. Kielb. *Production & Engineering Bulletin,* v. 4, June '45, pp. 90-92, 94, 96.

Time and costs in protective wrapping of tools and gages are cut by the application of ethylcellulose coatings. Damage to all types of tools in shipment or storage is drastically reduced by this method.

7-194. **Coating and Baking Metal Sheets.** Fred S. Bailey. *Modern Lithography,* v. 13, June '45, pp. 27-30, 79.

Materials; types of coaters; applications.

7-195. **Powdered Metal Spray.** P. Caredio and G. Duccini. *Western Machinery & Steel World,* v. 36, Aug. '45, pp. 348-349, 373.

Glaspray gun uses powdered metal, in readily obtained commercial grain sizes, and by absolute control of the torch temperatures, readies the old surface by bringing it to a temperature most receptive to the fusing temperature of the powder, and then applies, within the torch flame, a mass of uniform sized molten particles that present a known thickness of metal with every pass of the gun.

7-196. **Cleaning and Electroplate Finishing of Beryllium Copper Components.** E. E. Halls. *Metal Treatment,* v. 12, summer '45, pp. 71-85.

Corrosion resisting properties of beryllium copper, and processes employed for the removal of machine lubricants, oil and grease at intermediate or final stages of production. Artificial comparative corrosion tests are described and the results tabulated, while details of numerous acid solutions for removing oxide scale are given, together with particulars of sulphuric acid treatment followed by acid dichromate solution. Cleaning specifically for electroplating is dealt with, and the composition of several electrolytes is given.

7-197. **The Chemical Control of the Hot-Dip Galvanizing Process.** F. F. Pollak and E. F. Pellowe. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1349-1355.

Pickling procedure; rinsing and fluxing; drying and galvanizing practice; evaluation of the quality of the coating; examination of pickle solution; examination of flux solution; examination of etching solution; examination of spelter. 11 ref.

7-198. **Pre-Treating Metals for Quality Finish.** Gilbert C. Close. *Industrial Finishing,* v. 21, Aug. '45, pp. 24-28.

Clean surfaces of iron and steel will rust quickly unless they are immediately given a rust-proofing treatment or a protective coating. They can be painted, but if the paint film is scratched to expose the metal, rust can start, and once started, it may spread under the adjoining paint film, causing the film to flake off. But if the metal is given an effective rust-proofing after cleaning and before painting, it need not be painted immediately; then, if the paint film is scratched through, no rusting will occur. If the scratch is deep into the metal, the exposed metal may rust but the rust cannot spread farther because of the rust-proofed surface under the paint film.

7-199. **Electrostatic Spraying of Cartridge Tanks.** Fred M. Burt. *Industrial Finishing,* v. 21, Aug. '45, pp. 64-66, 68.
How cartridge tanks are formed by drawing; washing, rinsing, drying performed automatically; tanks revolve as they travel through spray; spraying in field of static electricity.

7-200. **Electrolytic Polishing.** *Steel,* v. 117, Sept. 10, '45, pp. 104-106.
Summary of the current status of the electro-polishing process shows why some producers of consumer articles may find it a tool for new finishing effects and possible economies.

7-201. **The Electro-Polishing of Metals.** N. A. Tope. *Engineering Materials and International Power Review,* v. 3, April '45, pp. 63-70.
Discusses its merits and potentialities. Development; the preparation of metallurgical microspecimens; commercial processes; miscellaneous metals; future trends. 17 ref.

7-202. **Protection of Iron and Steel.** U. R. Evans. *Metal Industry,* v. 67, Aug. 24, '45, pp. 114-118.
Of the methods available for the protection of iron and steel in the field, the author considers that the use of paints so richly pigmented with zinc as to constitute practically a galvanized coat offers distinct possibilities especially in the prevention of corrosion fatigue. 16 ref.

7-203. **Black Anodizing.** *Metal Industry,* v. 67, Aug. 24, '45, p. 118.
Production of a deep black color on copper and brass.

7-204. **Metals, Finishes, and Finishing Processes, Part II.** Edward Engel. *Iron Age,* v. 156, Sept. 13, '45, pp. 64-71.
Interest is centered in electropolishing, and the selection of surface finishes for functional and decorative purposes.

7-205. **Comments on Metal Cleaning.** Albert J. Pfetzing. *Industrial Gas,* v. 24, Aug. '45, pp. 11-14, 27-30.
Purpose of discussion is to create a more active interest in the planning and installation of metal cleaning equipment and to present practical information and ideas gathered mainly from both users and producers of cleaning equipment, and also the literature. Alkaline and solvent cleaning.

7-206. **Infra-Red Versus Convection Heating.** Charles C. Eeles. *Industrial Gas,* v. 24, Aug. '45, pp. 15-18, 32-36.
Determines the relative merit and future possibilities of so-called "convection" and "infra-red" equipment for curing industrial finishes. Time-temperature curing curve; curing time for single unit equalized; controlling results in infra-red ovens; formula for oven temperatures given; convection oven heats more uniformly.

7-207. **Chemical Processing Prior to Plating and Anodizing.** Carl Hirdler. *Metal Finishing,* v. 43, Sept. '45, pp. 368-370.
Key to successful cleaning is the selection of a cleaning method specialized for the kind of work which is being

cleaned, the kind of dirt to be removed, the characteristics of the metal being treated, and the degree of cleanliness required.

7-208. **Metals, Finishes, and Finishing Processes.** Edward Engel. *Iron Age,* v. 156, Sept. 20, '45, pp. 74-83.

Data correlated to aid in the selection of the proper metal, finish, and finishing process. Data given on proprietary plating baths, surface treatment of aluminum and magnesium alloys, etching procedures, dye coloring.

7-209. **The Chromate Passivation of Zinc.** S. G. Clarke and J. F. Andrew. Electrodepositors' Technical Society *Journal,* (Preprint), v. 20, 1945, pp. 119-138.

Results are presented of experiments on chromate films on zinc, produced by dipping in sodium dichromate solutions of the type used in the Cronak process and variations thereon. The work covered the effect of solution composition, time of immersion, etc., on the films produced and their characteristics, in particular the protective value under humid corrosion conditions. 5 ref.

7-210. **Anti-Corrosive Painting of Metals.** H. W. Rudd. *Paint Manufacture,* v. 15, July '45, pp. 183-188.

Basic principles of corrosion as applied to the metal surfaces underneath paint films. Some of the physical and mechanical processes which still result in the failure of too many paint systems designed to protect structural metals, and to indicate some of the essentials for success.

7-211. **Finishing Procedures at I.B.M.** *Die Casting,* v. 3, Sept. '45, pp. 68, 70-72.

Procedures standardized wherever possible so that the same coatings and equipment can be used for both die cast and sheet metal parts. This not only is an important cost saving feature but also results in a high over-all production rate.

7-212. **Anodizing of Aluminum Alloys.** Raymond J. Kwasnik. *Die Casting,* v. 3, Sept. '45, pp. 74-76, 78.

Anodic films may be produced by three separate methods; the thickness of physical properties of the film is dependent upon type of current, voltage, nature and concentration of anodizing reagents, temperature of solution, and the time interval of treatment.

7-213. **Cleaning, Painting, Drying Setup for New Metal Products.** Byron Morrill. *Industrial Finishing,* v. 21, Sept. '45, pp. 34-36, 79-80.

Engineering plans for a new conveyorized cleaning-painting-drying setup on a variety of products can be profitably patterned along the lines of the one illustrated for protectively coating rockets.

7-214. **Infra-Red vs. Convection Ovens for Drying Paint Coatings.** J. F. Gschwind. *Industrial Finishing,* v. 21, Sept. '45, pp. 46, 48, 50, 52, 54, 56, 58, 60.

Points out and compares some of the factors which must be considered when deciding the best heating means for an oven in which to quickly dry paint coatings at baking temperatures.

7-215. **Finishing Chairs on a Production Basis.** H. W. Chester. *Industrial Finishing,* v. 21, Sept. '45, pp. 64, 68, 70, 72, 74.

Chairs can be and are being entirely finished on overhead conveyor systems. Many chair factory finishing departments are fully conveyorized, with the result that production is increased and costs reduced.

7-216. **The Passivation of Zinc Using Dichromate Base Solutions, with Special Reference to Electro-Zinc Deposits.** E. E. Halls. *Metallurgia,* v. 32, July '45, pp. 99-104.

Passivation and chromatizing treatments of zinc surfaces have been developed to increase the service obtainable and thereby provide the maximum efficiency with the minimum of raw material. Gives the results of experimental investigations.

7-217. **The Finishing of Light Alloys. Part VII.** H. Silman. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1398-1402, 1417.

Sealing by impregnation; oxalic acid process; aluminum reflectors; immersion treatments; M.B.V. process; Pylumin process; painting on aluminum; electroplating on aluminum; nickel plating; protection of magnesium; half-hour chromizing process; anodic treatment; chrome pickle; stripping; painting. 5 ref.

7-218. **Effect of Polishing Steel.** *Steel,* v. 117, Sept. 17, '45, pp. 143, 146, 188, 190.

Results of studies to determine whether surface finish of a steel affects protective value of plated coating are timely and of interest to all fabricators of steel products requiring a protective or "bright" plate. 7 ref.

7-219. **The Effect of Chemical Surface Treatments on the Scuffing of Gears.** H. D. Mansion. *Engineering,* v. 160, Aug. 31, '45, pp. 178-180.

After the deep phosphate treatment had been investigated, a pair of gears was given a shallow phosphate treatment, and the corresponding results are shown. Gears were then run for 1 hr. at the running-in load, measured and photographed again. Afterwards they were run for another 99 hr., measured and photographed once more. They were finally subjected to a standard scuffing test. Tests considered individually and characteristics given.

7-220. **Infra-Red Lamps Speed Finish Baking.** *Aero Digest,* v. 51, Oct. 1, '45, pp. 80, 92.

Applications in which the finishes baked give off volatiles with flash points so low as to constitute a real hazard. Volatiles with a flash point below 100° C. present a hazard regardless of whether the heat source is a lamp, lens, metallic or ceramic surface, open flame or electric arc.

7-221. **Calculatory Methods for the Economic Repolishing of Sintered Carbide Dies.** P. Grodzinski. *Wire Industry,* v. 12, Sept. '45, pp. 469-470.

Problem of how much should be removed in radial and axial directions can be partly solved by mathematical treatment. Further problem is to provide the necessary means for measuring and adjusting the machines, as well as tables and nomograms to help the operator. Deals mainly with the calculatory side of the problem.

7-222. **Cleaning and De-Whiskering Nails.** N. Ransohoff. *Wire & Wire Products,* v. 20, Oct. '45, pp. 733-734, 810.

New method described.

7-223. **Pickling With Submerged Combustion.** H. N. Snowden. *Wire & Wire Products,* v. 20, Oct. '45, pp. 750-751.

Presents the results obtained in using direct fired equipment for the purpose of heating and agitating acid pickling tanks.

7-224. **Fundamentals of Finishing Magnesium.** *Modern Metals,* v. 1, Oct. '45, pp. 26-28.

Information as to types of finishes to be used for specific peacetime applications.

7-225. **Soft-Grit Blasting of Metals.** E. C. Lathrop and S. I. Aronovsky. *Compressed Air Magazine,* v. 50, Oct. '45, pp. 268-272.

"Soft-grit" blasting process for removing hard, thick carbon deposits from cylinders and pistons of aircraft engines has resulted in considerable savings in man-hours. Process is almost fool-proof, since properly chosen soft grits do not change the dimensions of the objects, and no masking or hand tools are required.

7-226. **Metal Cleaning, Finishing, Protection—a Symposium.** *Metal Progress,* v. 48, Oct. '45, pp. 957-969.

Process engineering of surface conditioning and finish, by George Onksen. Blast cleaning of metal, by A. L. Gardner. Surface preparation of cast iron, by J. H. Shoemaker. Improvements in zinc and nickel coatings, by Myron B. Diggin. Improvements in other protective metallic plates, by R. B. Saltonstall. Oxide finishes on copper, steel and aluminum, by Walter R. Meyer. Chromate finishes on zinc, cadmium and magnesium, by R. M. Thomas.

7-227. **Metallizing—A Maintenance Tool.** *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 46-47.

Cost savings are effected by reclaiming worn parts, but even more important, particularly in the drive of war production, are the applications that have enabled large production units to get back into operation without long delays which would have occurred had the process not been used. Summarized are several of these cases.

7-228. **Final Cleaning and Painting.** Walter J. Brooking. *Canadian Metals & Metallurgical Industries,* v. 8, Sept. '45, pp. 25-29, 47.

Elements which make final cleaning and painting departments important; special problems of a cleaning and painting department supervisor; other departmental help for the cleaning and painting foreman; margins of efficiency in a cleaning and painting department.

7-229. **Die Castings Can Be Colorful.** *Die Casting,* v. 3, Oct. '45, pp. 42-43.

Recently developed finishes now make it possible to combine all the elements of "styling" into a metal product which still provides many advantages over other methods of production. The smooth die cast surface with proper pretreatment is an ideal base for subsequent finishing for appearance and protection.

7-230. **Anodizing of Aluminum Alloys.** Raymond J. Kwasnik. *Die Casting,* v. 3, Oct. '45, pp. 64-66.

Considers the popular alloys used in die castings, numbers 13, 43 and 360, containing 12%, 5% and 9.5% of silicon respectively. Alloys degreased and given a caustic treatment become covered with a powdery smut that cannot be removed by the 30% nitric acid dip. They anodize poorly, their dielectric is low and the surface is both unsightly and covered with a smudge. The dyeing properties are poor, the product dusty. Technique to be observed given.

7-231. **Chemical Treatments for Zinc Alloy Die Castings. Part II. Black Nickel Salts.** *Die Casting,* v. 3, Oct. '45, pp. 76-79.

Includes several types of black finishes, containing nickel salts, that are produced by either simple immersion or as a result of electrolytic action.

7-232. **Animal Glue in Abrasive Processes.** H. B. Sweatt. *Metal Finishing,* v. 43, Oct. '45, pp. 415-416.

Storage and preparation; wheel set-up; wheel drying; manufacture of glue.

7-233. **Metals, Finishes, and Finishing.** Edward Engel. *Iron Age,* v. 156, Sept. 27, '45, pp. 65-68.

Data on infra-red drying time, tinting and hiding power of white pigments, luminescent coatings, testing equipment and procedure for metal finishes.

7-234. **The Technique of Sheet Galvanizing by the Hot Dip Process.** Harold Edwards. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1546-1552.

Deals mainly with the galvanizing of mild steel sheets by the hot dip process, which is divided into two major operations. The preparation of a clean metallic surface and the coating of the prepared surface with zinc. Pickling equipment and practice. 10 ref.

7-235. **The Brittleness of the Enamel of Coated Aluminum Wire at Normal and Higher Temperatures.** E. Greulich. *Elektrotechnische Zeitschrift,* no. 17-18, May 6, '45, pp. 241-242. *Engineers' Digest* (American Edition), v. 2, Sept. '45, pp. 453-455.

Difficulties in the production of enamel-coated aluminum wire are due to the propensity of the coating to become brittle if the wire is stored for any length of time. The adhesion between the enamel and the metal core decreases and the wire becomes unsuitable for further use. If the assumption that the brittling of the enamel is due to the absorption of oxygen is correct, it was to be expected that the quality of the wire could be improved by using coatings of oilless artificial resins instead of the oil-containing enamel used hitherto. Validity of these assumptions, and the properties of wire with coatings of artificial resins were investigated in a series of tests carried out with aluminum wires of 0.9 to 1.1 mm. diameter produced from the same batch.

7-236. **Modern Metal Protection—a Symposium.** Allen G. Gray. *Steel,* v. 117, Oct. 15, '45, pp. 116-120, 172, 174, 177-178.

Basis for comparison of several methods of metal protection is provided by data—properties, advantages and limitations and general possibilities for several types of corrosion protecting finishes.

7-237. **New Cleaning Process Affords Brighter Finish on Nails.** *Steel*, v. 117, Oct. 29, '45, pp. 116, 118.

Process described by M. Ransohoff, president, Ransohoff Co., at the annual meeting of the Wire Association. By the new method of cleaning and dewhiskering nails the amount of labor is reduced, the rate of operation increased and a superior product obtained.

7-238. **Anodic Coatings With Crystalline Structure on Aluminum.** Cyril S. Taylor, C. M. Tucker and Junius D. Edwards. Electrochemical Society Preprint 88-9, 1945, pp. 107-114.

Variety of experiments which indicate that an X-ray diffraction pattern corresponding to that of gamma alumina is obtained when the formation potential is above about 100 volts. Formation of a crystalline coating does not seem to be a characteristic of the electrolyte, for crystalline coatings were obtained with a variety of electrolytes. High electric stress seems to favor the formation of an ordered oxide lattice. 12 ref.

7-239. **Bright Dipping.** Gustaf Soderberg. Electrochemical Society Preprint 88-10, 1945, pp. 115-120.

Defines bright dipping, reviews existing bright dipping processes for copper and its alloys, cadmium plate and zinc plate, magnesium and lead. Applications are listed and discussed. Theory of bright dipping, paralleling that for anodic brightening, is proposed.

7-240. **Automatic Spray Painting.** W. Beacham. *Industrial Finishing*, v. 21, Oct. '45, pp. 36-40, 42, 44, 46.

Some of the merits, possibilities and limitations of automatic spray painting. What you need to know and do to put in, set up, operate and maintain this kind of specialized high-production equipment in order to make it really successful and profitable.

7-241. **Priming Aluminum Sheets Two Sides by Roller Coating.** *Industrial Finishing*, v. 21, Oct. '45, pp. 48-50.

With the aid of a specially formulated zinc chromate primer, job is being accomplished by the use of new equipment which combines a series of tanks, driers and rollers. Crew of six men now prime-coat both sides of large aluminum sheets at the rate of 350 an hour; whereas by former methods the same crew could do only 18 or 20 sheets an hour.

7-242. **Our Pattern for Reconversion.** Dale W. Musselman. *Industrial Finishing*, v. 21, Oct. '45, pp. 62, 64, 66, 68, 70.

Progressive arrangement of work stations along well planned conveyor lines. Particular attention to treating and conditioning all surfaces before painting; and to quickly drying the paints.

7-243. **Controlled Barrel Burnishing Action Imparts Precise Finish to Metal Parts.** *American Machinist*, v. 89, Oct. 25, '45, pp. 114-117.

Deburring and polishing parts using wood-lined barrels and granite chips resulted in the elimination of hand finishing.

7-244. **Use of Infra-Red Radiation in Drying Operations.** A. L. Roberts. *Steel Processing,* v. 31, Oct. '45, pp. 649-651.
For the majority of industrial solids, the direct heating effect of radiation is confined to the surface of the material, and, for this reason, radiant heating processes are best suited to simple and thin shapes, in which as much as possible of the surface area of each individual article can be exposed to radiation.

7-245. **Solvents in the Paint Industry, Part 5.** Richard B. Pollak. *Paint, Oil & Chemistry,* v. 108, Oct. 4, '45, pp. 14, 22.
Inflammability of solvents. 5 ref.

7-246. **New Process Speeds up Galvanizing of Wire.** *Steel,* v. 117, Nov. 5, '45, pp. 136, 138.
Stream of molten zinc kept in circulation well above dross line. Wire coated by this process is drawn to diameter corresponding to 95% reduction of area with speeds in some fine sizes of 2000 fpm. Tensile and torsional values on galvanized rope wire are above specified range and coatings are uniform and resist abrasion.

7-247. **Processing Metal Components at Windsor Engineering.** Fred M. Burt. *Products Finishing,* v. 10, Oct. '45, pp. 41-42, 44, 46, 48.
In the plant of Windsor Engineering Co., Inc., Glendale, Calif., hundreds of thousands of aircraft component parts, ranging from tiny springs to ammunition trays and air scoops or collectors, are given the Irco-Izing process chemical dip treatment to inhibit rust and are then dipped and/or sprayed. In addition, many other metal parts are similarly processed for other plants in the country. View of production line shown.

7-248. **Finishing Clinic.** Allen G. Gray. *Products Finishing,* v. 10, Oct. '45, pp. 50-52, 54, 56, 58, 60, 62.
Evaluation of surface finishes; brass plating—still most widely used method for rubber adhesion; electropolishing—present status; aluminum coated steel—new possibilities; strip for lead coatings; analysis of hydrofluoric-nitric acid pickling bath.

7-249. **Performance Tests for Metal Finishes.** Burr Price. *Products Finishing,* v. 10, Oct. '45, pp. 94-96, 98, 100, 102.
Mechanical testing for performance; the conical mandrel; scratch adhesion and mar testing; abrasion resistance of coatings on aluminum.

7-250. **White Porcelain Enamel Color Variation and Its Control.** R. F. Duncan. *Enamelist,* v. 22, Oct. '45, pp. 10-14.
Methods of matching; stabilizing compounds; numbering systems; functions of stabilite; how to use.

7-251. **How to Choose an Organic Finish Before Starting Production.** P. W. Prouty. *Enamelist,* v. 22, Oct. '45, pp. 15-24, 51-52.
Compositions and properties; selection of finishes; testing; making test samples; evaluation of results.

7-252. **The Classification and Properties of Porcelain Enamels, Part II.** *Enamelist,* v. 22, Oct. '45, pp. 25-30.

Methods of testing described. 8 ref.

7-253. **Low Temperature Ceramic Finishes for Home Appliances.** Gilbert C. Close. *Finish,* v. 2, Nov. '45, pp. 13-15.

New type infra-red home heater unit employs alumina silicate coating.

7-254. **Sodium Hydride Process for Descaling Steel.** J. Albin. *Iron Age,* v. 156, Nov. 8, '45, pp. 58-63.

Descaling is uniformly accomplished without hydrogen embrittlement or loss of metal, and in generally less time than by other pickling methods. Discusses the development of the process by du Pont and includes practical data for large scale application.

7-255. **The Technique of Sheet Galvanizing by the Hot Dip Process.** Harold Edwards. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1725-1730, 1736.

The action of molten zinc on iron and steel; the influence of nickel and chromium plating; galvanizing bath design. 10 ref.

7-256. **The Surface Preparation of Certain Cold-Worked Steels by Pickling.** P. D. Liddiard. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1731-1736.

Recommends the use of a solution containing nitric and sulphuric acids for the surface preparation of cold-reduced steel, prior to subsequent protective treatment. 3 ref.

7-257. **The Influence of Natural Convection on the Effectiveness of Radiant ("Infra-Red") Heating and Its Bearing on the Choice of Heating Systems.** J. B. Carne. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1757-1763.

Attention is given mainly to the physical factors on which attainable temperature depends. 3 ref.

7-258. **Metal Finishing, Part VIII.** H. Silman. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1773-1774, 1781-1786.

Paints, varnishes and enamels; their formulation and application.

7-259. **Steam Turbine Repaired by Metallizing.** Henry M. Atwood. *Power Plant Engineering,* v. 49, Oct. '45, p. 71.

By metallizing, piece of equipment costing over $60,000 and not replaceable under present conditions has been restored to service at a cost of less than $215.

7-260. **Lengthening the Life of Painted Steel.** *Tin and Its Uses,* no. 16, Sept. '45, pp. 3-4.

A very thin coating of tin provides a considerably greater immunity to rusting and, in many cases, may be more convenient and cheaper to apply than a phosphate coating.

7-261. **The Value of Tin on a Can.** W. R. Lewis. *Tin and Its Uses,* no. 16, Sept. '45, pp. 5-7.

Efforts have been made to use thinly coated electrolytic tinplate and lacquered blackplate as substitutes for hot-dipped tinplate. Experience indicates that the utility of lacquered blackplate is limited and that cans made from

thinly coated tinplate must be lacquered inside and outside to approach the performance of plain hot-dipped tinplate cans. 4 ref.

7-262. **Problems Connected With Reclamation of Worn Parts by the Metal-Spraying Process.** W. E. Ballard. American Society of Naval Engineers *Journal,* v. 57, Nov. '45, pp. 551-557.

Is metal spraying a suitable method of reclamation; how must the work be prepared for spraying; what method of spraying and which metal should be used; what finish is necessary. (Reprinted from *Journal and Proceedings* of the Institution of Mechanical Engineers.)

7-263. **Chromate Deposits.** S. G. Howden-Simpson. *Metal Industry,* v. 67, Oct. 26, '45, pp. 258-261.

Experimental evidence shows that best deposit from hot chromate bath (DTD 911) for protection of magnesium is obtained with an immersion time of 10 minutes and a pH of 6.0.

7-264. **Die Castings Can Be Colorful.** *Die Casting,* v. 3, Nov. '45, pp. 42-44.

Various factors in a properly organized finishing system reviewed.

7-265. **Chemical Treatments for Zinc Alloy Die Castings. Part III.** *Die Casting,* v. 3, Nov. '45, pp. 62-64, 66.

Phosphate treatments discussed.

7-266. **Anodizing of Aluminum Alloys. Part 3.** Raymond J. Kwasnik. *Die Casting,* v. 3, Nov. '45, pp. 68, 70, 72, 74.

Discusses various electrochemical finishes for aluminum alloy die castings, other than anodic coatings, with particular reference to proprietary plating procedure, plating, chemically created oxide films, painting and lacquering.

7-267. **Infra-Red in the Finishing of Die Castings.** Ira J. Barber. *Die Casting,* v. 3, Nov. '45, pp. 76, 78, 80-82.

Comprehensive discussion on infra-red and its place in the die-casting finishing picture.

7-268. **The Chromate Passivation of Zinc.** S. G. Clarke and J. F. Andrew. *Industrial Chemist,* v. 21, Oct. '45, pp. 549-554.

Chromate passivation produces a thin colored film on zinc, zinc plating and zinc die-casting alloy by simple non-electrolytic immersion in a cold acidified dichromate solution. The aim of the treatment is to give improved corrosion resistance in particular under humid conditions.

7-269. **Metal Cleaning: II—Soil Removal Performance Methods.** Jay C. Harris. American Society for Testing Materials *Bulletin,* no. 136, Oct. '45, pp. 31-39.

Attempts to cover direct evaluation of metal cleansers by measurement of their relative ability to remove a given soil by laboratory methods. Approach yields an immediate answer, when applied to soiled surface in question, but may leave unanswered problem of whether such a composition will remove a soil of other, perhaps quite dissimilar, characteristics. 5 ref.

7-270. **Electrostatic Spraying of Porcelain Enamels.** James B. Willis. *Steel,* v. 117, Nov. 12, '45, pp. 118-120, 162, 165-166, 168, 170, 173, 176.

Appreciable savings result in material consumed and uniformly coated product is produced with minimum loss from overspray. Process valuable in spraying flat surfaces with simple flanges, or symmetrical shapes—especially where operation is highly repetitive. No special preparation of enamel required but accurate control of its physical properties is essential.

7-271. **Sodium Hydride Descaling.** L. W. Townsend. *Steel,* v. 117, Nov. 12, '45, pp. 122-123, 180, 182, 184.

Bath containing active sodium hydride penetrates through stainless steel and uniformly descales all surfaces with no loss of metal and no deleterious effect on structure. Disposal of waste residue eliminated.

7-272. **Taking It Off?** George Black. *Metal Finishing,* v. 43, Nov. '45, pp. 457-458.

Presentation of current methods of stripping metallic coatings.

7-273. **Crazing of Enamel on Stove Tops Due to Heating in Service.** Roger Fellows. *Better Enameling,* v. 16, Oct. '45, pp. 8-14.

Stove tops that have tensile strains in the enamel due to fabrication or assembly are likely to craze in the areas of these stresses. The lighter the weight of application of cover coat, the greater is the resistance to crazing. The heavier the gage of metal, the greater is the resistance to crazing. 4 ref.

7-274. **Surface Finishing of Beryllium-Copper.** *Iron Age,* v. 156, Nov. 15, '45, p. 63.

Beryllium-copper components benefit when given electroplate finishes satisfactory for other copper-rich alloys. Details of numerous acid solutions for removing oxide scale given, with particulars of sulphuric acid treatment followed by acid dichromate solution. Cleaning specifically for electroplating is also discussed.

7-275. **Surface Preparation With Abrasive Belts.** E. E. Oathout. *Products Finishing,* v. 10, Nov. '45, pp. 54-56, 58, 60, 62.

Surface preparation of metals by means of coated abrasive belts has been thoroughly "combat" tested for speed, cost reduction, and quality. Idler backstand pulley and contact wheel provide for greatly increased operator ease and a lowering of the operator's skill requisite.

7-276. **Finishing Clinic.** Allen G. Gray. *Products Finishing,* v. 10, Nov. '45, pp. 76-78, 80, 82, 84, 86.

Effect of polishing on protective value of plated coatings; spot welding aluminum coated steel; selection and application of organic finishes; new economy in spent pickle liquor treatment; porcelain enamel possibilities; dyed aluminum.

7-277. **Descaling Stainless Steel.** *Steel,* v. 117, Nov. 19, '45, pp. 120-121, 180, 182.

Installation at Rustless Iron & Steel Corp. provides uniformly scale-free surfaces for wire and bars by immersing in fused caustic bath.

7-278. **Enamel-Coated Aluminum Wire.** E. Greulich. *Wire Industry,* v. 12, Nov. '45, pp. 585-586.

Tests carried out with aluminum wires of 0.9 to 1.1 mm. diameter produced from one and the same batch. Coating of wires consisted of an enamel with 37% oil content and of an oilless artificial resin. Third sample had coating of three inner layers of oilless artificial resin and of three outer layers of the oil containing enamel. Method of investigation. (From *Engineers' Digest.*)

7-279. **Combined Anodizing-Chromatizing Layout at the Hughes Plant.** G. A. Studer. *Automotive & Aviation Industries,* v. 93, Nov. 1, '45, pp. 32-34, 85-86, 88.

Six-tank arrangement satisfactorily does the job. Load frames provided that can be used for either process. All baskets have fixed casters equipped with Oilite bearings and stainless steel shaft so that they will always roll easily and not become rusted when immersed in the liquid. All work holders for the anodizing process must be made of aluminum or dural, because if the part, during the anodizing process, comes in contact with steel it will burn the point of contact. These same work holders can be used for chromatizing. Entire procedure given.

7-280. **Choice of Organic Finishes.** P. W. Prouty. *Industrial Finishing,* v. 22, Nov. '45, pp. 36-38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58.

What paints and lacquers are actually made of; names of synthetic resins; chief characteristics of certain synthetics; prehistoric and present lacquers; how finishes are selected for new products; clean surfaces necessary for successful painting; points to consider when trying out new finishes; what tests to make and how to make them; grease and oil resistance.

7-281. **Cleaning, Conditioning Steel for Painting.** Arthur P. Schulze. *Industrial Finishing,* v. 22, Nov. '45, pp. 64, 66. 68, 70, 72, 74.

Controlled phosphate coating, preceded by thorough cleaning, then followed by painting, offers several merits, among them being much better paint adhesion and greatly improved resistance against rusting or the spread of rust wherever a painted surface is scratched to expose bare metal.

7-282. **Metal Cleaning and Rinse Tanks.** A. P. Schulze. *Industrial Finishing,* v. 22, Nov. '45, pp. 74, 79.

Number of important points relative to cleaning tanks.

7-283. **Drying by Infra-Red.** *Industrial Finishing,* v. 22, Nov. '45, pp. 80, 82, 84, 86.

Two letters commenting on article published in Sept. issue, entitled, "Infra-Red vs. Convection Ovens for Drying Paint Coatings", by J. F. Gschwind.

7-284. **Metal Surfaces.** *Metal Industry,* v. 67, Nov. 16, '45, pp. 313-317, 326.

Report of conference held in Paris.

7-285. **Oxalic Acid Etching.** G. R. Makepeace. *Metal Industry,* v. 67, Nov. 16, '45, pp. 318-320.

New pre-treatment for "hard" chromium plating. (From *Metal Finishing.)*

7-286. **Process Control for Anodizing Aluminum—I and II.** *American Machinist,* v. 89, Dec. 6, '45, pp. 137, 139.

For maximum protection, best to anodize after parts have been completely machined, welded or otherwise worked upon up to point of applying paint. Film insures good adherence of paint and can be dyed if desired. If paint is to be applied, zinc chromate primer sprayed upon film soon after rinsing and drying anodized pieces.

7-287. **Soft-Grit Blasting of Cylinders.** J. Albin. *Iron Age,* v. 156, Nov. 22, '45, pp. 65-67.

Coffee grounds, among other soft grits, are being used in former sandblast equipment of American Airlines to remove carbon deposits from airplane engine pistons and cylinders.

7-288. **Performance and Structure of Anodic Coatings on Aluminum.** F. Keller and Junius D. Edwards. *Iron Age,* v. 156, Nov. 22, '45, pp. 75-78.

Service afforded by anodic coatings on aluminum can be controlled by choice of production procedures employed. Structures of these coatings, factors affecting their serviceability and results of various tests are described.

7-289. **Vapor Degreasing.** J. C. Joyce. *Steel,* v. 117, Nov. 26, '45, pp. 110, 112, 115, 116.

Equipment and methods keep pace with improvement in solvents. Efficiency of electric and gas-heated degreasers gives maximum production in minimum space, complete penetration of close-fitting parts without disassembly and reduced handling.

7-290. **Selection of Metal Cleaning Methods.** Charles Delmar Townsend. *Materials & Methods,* v. 22, Nov. '45, pp. 1411-1417.

Considerations which must be studied are types or kinds of metals to be cleaned; surface conditions of metals; degree of cleanliness required for subsequent surface treatments; shape, size and fragility of part to be cleaned; production rate required; condition of parts for next operation—whether wet or dry, hot or cold; availability of heating medium for the solution; and floor space availability.

7-291. **Rapid Polishing of Light Metal Metallographic Samples.** George Whittington. *Light Metal Age,* v. 3, Nov. '45, p. 31.

Method of rapid metallographic polishing of aluminum and magnesium or any other non-ferrous metal which in two to three minutes will produce a micro sample suitable for routine inspection.

7-292. **The Preservative Qualities of Aluminum Paint.** *Aluminum & the Non-Ferrous Review,* v. 10, July-Sept. '45, pp. 38, 40, 42.

Advantages make aluminum paint ideal for painting lamp-posts, refuge posts, sand bins, transformer boxes, signposts, and similar objects, as such paint not only protects them from effects of weather, but enables them to be easily seen at night or in dull or foggy weather.

7-293. **Technique of Sheet Galvanizing by the Hot Dip Process.** Harold Edwards. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1914-1921.

Preparation of the spelter bath; introduction of the gal-

vanizing frame into the bath; typical skimming roll; spelter bath; bath temperature; operating speed; sprays; finishing; properties of galvanized sheets; uncoated surface; influence of the steel base; microstructure. 7 ref.

7-294. **Electrolytic Methods of Polishing Metals. Part X.** S. Wernick. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1951-1958.

Electrolytic polishing of carbon steels. 10 ref.

7-295. **Metal Finishing. Part VIII.** H. Silman. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1967-1971.

Paints, varnishes, and enamels; their formulation and application. 4 ref.

7-296. **Enamel Problems Traced to Steel and Weather.** *Ceramic Industry,* v. 45, Oct. '45, pp. 66-67.

All solutions lead to slower oxidation of steel in firing process with thinner coats and adequate adherence as ultimate goal.

7-297. **Checking Pickle Room Operations.** *Ceramic Industry,* v. 45, Nov. '45, pp. 60-61.

Three "musts" are to keep solutions up to strength, keep them clean, and observe proper temperature conditions.

7-298. **Protective Plastic Coatings for Precision Tools.** R. L. Geehr. *Tool & Die Journal,* v. 11, Nov. '45, pp. 99-100.

Protective thermoplastic coating for costly precision and carbide tipped tools and gages is inexpensive as compared with previous methods of wrapping and preservation. Improved formulations are transparent, have greater tensile strength, are highly resistant to shock and abrasion and are non-toxic.

7-299. **Nickel Flashing and Its Relation to Enamel Adherence.** Eugene Wainer and W. J. Baldwin. American Ceramic Society *Journal,* v. 28, Nov. 1, '45, pp. 317-326.

Nickel flashing as applied to enameling stock shown to be primarily metallic nickel. Role of nickel in developing enamel adherence is apparently bound up with the retardation of oxidation which the nickel flash imparts in the enameling cycle.

7-300. **Color Merchandising of Metal Products.** Edward Engel. *Iron Age,* v. 156, Dec. 6, '45, pp. 77-79.

Data and charts indicate popular preferences for color and color arrangements.

7-301. **Vitreous Enameling in Australia.** T. B. Simpson and S. H. Dunstone. *Finish,* v. 2, Dec. '45, pp. 13-16, 50.

History of one of Australia's oldest manufacturing and enameling companies, plus comparisons with American manufacturing.

7-302. **New Pickling Room Has Many Features.** M. B. Smith and Richard Carno. *Finish,* v. 2, Dec. '45, pp. 17-18, 52.

Suggestions for those who are building or modernizing pickle room installations.

SECTION VIII

ELECTROPLATING

8-1. **Plated Plastics—Don't Sell Them Short!** Jeffrey Ames. *Products Finishing,* v. 9, Jan. '45, pp. 28-30.

Plated plastic is considerably lighter than an all-metal object, has improved moisture resistance, and may be protected from many solvents. Part retains all the detail of its easily obtained complex design. Retains its non-conducting properties, is more resistant to heat and vibration and also stronger than an all-plastic article and is not subject to the corrosion that is often encountered due to the electrolytic action between the layers of a metal to metal plating job.

8-2. **Electroplating Facilities Centralized at Republic Plant.** *Automotive Industries,* v. 92, Jan. 15, '45, pp. 30, 32, 116.

Facilities and equipment.

8-3. **The Fundamentals of Chemistry for Electroplaters. XV.** Samuel Glasstone. *Monthly Review,* v. 32, Jan. '45, pp. 19-22.

The preparation and properties of salts.

8-4. **Inspection and Rating of Test Panels Employed in the Outdoor Exposure Tests of Electroplated Coatings.** C. H. Sample. *Monthly Review,* v. 32, Jan. '45, pp. 23-24.

A rating scheme which provides results directly in terms of percentage of the surface failed, stained, or otherwise degraded from its original condition after a given period of exposure is of more practical value to industry than the method employed in the tests under consideration.

8-5. **The Contribution of Electroplating Directly to the War Effort.** Guerin Todd. *Metal Finishing,* v. 43, Jan. '45, pp. 8-9.

Summary of advances and uses.

8-6. **Plating Locomotive and Passenger Equipment Car Parts.** T. R. Boggess. *Metal Finishing,* v. 43, Jan. '45, pp. 14-15.

A pictorial review of electroplating locomotive and passenger equipment car parts, as practiced in the Norfolk and Western Railway Co.'s Shops at Roanoke, Va.

8-7. **Plated Plastics.** Stanley H. Brams. *Iron Age,* v. 155, Feb. 1, '45, pp. 62-65.

Plated plastics have some interesting postwar possi-

bilities. Cost factors are usually higher than for plated metals, but there are some compensating advantages, including resistance to corrosion. Data on physical properties are included.

8-8. **Strip Plating Evaluation.** D. A. Swalheim. *Metal Industry,* v. 66, Jan. 5, '45, pp. 10-12.

Application of ordinary control methods to continuous electroplating baths is rendered difficult by the high operational speeds and high current densities employed; describes the development of a rotating cathode cell designed for this special purpose. (Presented to the Electrochemical Society.)

8-9. **Copper Plating on Aluminum.** *Products Finishing,* v. 9, Feb. '45, p. 48.

Adherent, uniform copper plating is possible on aluminum and its alloys by means of a simple preparatory dip at room temperature. The dipping solution may be used in a steel, wood, or ceramic container, and, since no fumes are said to be given off, venting is not required. The solution has a long life, is stable, and not sensitive to drag-out, normal contamination, or dilution.

8-10. **Film in Chromium Electroplate.** J. B. Cohen. Electrochemical Society Preprint no. 86-28, Oct. '44, 14 pp.

Film-like network of a compound of chromium existed within the several electrochromium deposits which were examined. This network was associated with the usual crack system observed in chromium electroplates. The film isolated from a heated (482° C. for 2 hr.) chromium plate was investigated through spectrographic analyses, micro-chemical analyses, and X-ray diffraction studies and was found to consist of Cr_2O_3 and was about 0.05% by weight of the deposit. The "as-plated" compound is probably a hydrated chromium oxide.

8-11. **The Lead and Allied Plating of Bearings.** O. Wright. *Journal of Electrodepositors' Technical Society,* Reprint, v. 20, '45, pp. 1-16.

The requirements of bearings for internal combustion engines; lead plating bearings together with information on baths used; indium plating; inspection and control. 14 ref.

8-12. **Electro-Plating on Wire.** John Kronsbein and Alan Smart. *Journal of Electrodepositors' Technical Society,* Reprint, v. 20, '45, pp. 31-38.

Bimetallic wires; reasons for their adoption; methods of manufacture; hot-dipping; drawing; electroplating; original methods of wire plating; a recent design; detail construction; electrical control; plating current; tank heating; uncoiling and jointing; operation of the plant; output of the plant; heat treatment; strand annealing; batch annealing.

8-13. **An Investigation on the Silver Plating of Steel.** J. M. Sprague. *Journal of Electrodepositors' Technical Society,* Reprint, v. 20, '45, pp. 39-46.

Investigation to obtain silver plate, up to approximately 0.002 in. thick, on steel to specification D.T.D. 306 the coating being tested to withstand a temperature of 400° C. for a least one hour without blistering or apparent decrease in adhesion. Of interest where highly adherent silver plate is required for engineering purposes. 5 ref.

8-14. **Electroforming.** F. K. Savage. *Metal Industry,* v. 66, Jan. 19, '45, pp. 42-44.

Numerous industrial applications for electroforming have been made in spite of the lack of knowledge of this subject; describes the formation of trumpet bells by this method. (Presented to the American Electroplaters' Society.)

8-15. **Adhesion of Electrodeposits.** B. F. Lewis. *Monthly Review,* v. 32, Feb. '45, pp. 139-147.

Good adhesion throughout the service life of plated parts is promoted by the following factors: Surface of the basis metal must be free of loose smut or other foreign matter and must be finished by methods which remove, rather than form, a layer of cold-worked metal. This can be accomplished mechanically by buffing rather than polishing. Electrodeposition, once started, must not be interrupted until the total desired thickness of any given coating has been applied. Weather blistering may be minimized by observing the foregoing factors, plus thorough purification of plating baths, adequate thickness, and subsequent care and cleaning of the plated parts.

8-16. **Colorimetric Methods as Applied to the Analysis of Electroplating Baths.** D. Gardiner Foulke. *Monthly Review,* v. 32, Feb. '45, pp. 149-152.

Method for the determination of relatively small amounts of chromic acid in nickel and copper baths. Method described is the diphenylcarbazide method which is extremely sensitive as well as capable of giving results of high reproducibility. 3 ref.

8-17. **The Fundamentals of Chemistry for Electroplaters, XVI: Solutions and Solubility.** Samuel Glasstone. *Monthly Review,* v. 32, Feb. '45, pp. 155-158.

The nature of solutions; saturated solutions and solubility; purification by recrystallization; range of solubility; types of solution.

8-18. **A High pH Indium Cyanide Bath.** J. B. Mohler. *Metal Finishing,* v. 43, Feb. '45, pp. 60, 77.

Laboratory scale investigation. Preparation of baths described. 8 ref.

8-19. **High-speed Alkaline Tin Plating.** Martin M. Sternfels. *Metal Finishing,* v. 43, Feb. '45, pp. 52-55.

History; modern baths; potassium vs. sodium; the potassium stannate bath.

8-20. **Wire Plating.** J. Kronsbein and A. Smart. *Metal Industry,* v. 66, Feb. 2, '45, pp. 73-76.

Plant designed to electroplate wires up to about 16 s.w.g. described in paper presented to the Electrodepositors' Technical Society. In this plant the wire is

positively driven throughout its length, and consequently the tension applied to it is limited to a low figure.

8-21. **Adjustable Anode Rack Aids Plating.** *Iron Age*, v. 155, March 1, '45, p. 57.

Faster plating of irregularly shaped parts and more uniform metal deposits are being achieved through the use of a new adjustable anode rod.

8-22. **Electroplating Nickel From Low pH Electrolytes.** E. E. Halls. *Metal Treatment*, v. 11, Winter '44-45, pp. 235-243.

Development of low pH values in electroplating baths, having for their object speed of operation in the production of coatings of quality equal to those normally produced.

8-23. **Silver Plating.** J. M. Sprague. *Metal Industry*, v. 66, Feb. 16, '45, pp. 106-108.

Adherent silver coatings for engineering purposes. (Electrodepositors' Technical Society.) 3 ref.

8-24. **Determining the Area of Parts to Be Plated.** Joseph Haas. *Metal Finishing*, v. 43, March '45, pp. 94-96.

Electrodepositing a metal to a specified amount per article or unit of articles does not present any difficult problem. All that is required is simple multiplication, knowing the total amount of metal to be deposited, and then calculating the time at a certain amperage to obtain that quantity of metal, making allowances for the current efficiency of the solution. Problem presented.

8-25. **Continuous Plating of Fine Steel Wire with Nickel.** James H. Conolly and Richard Rimbach. *Metal Finishing*, v. 43, March '45, pp. 97-99, 101.

Due to the scarcity of nickel a nickel-plated steel wire is used today in place of solid nickel wire for tungsten filament supports in incandescent lamps. The steel wire passes through a concentrated Watts' nickel plating bath at the rate of 12 ft. per min. (90 mm. per sec.) at a current density of 200 to 600 amp. per sq. ft. (22 to 65 amp. per sq. dm.); a bath pH of 2.0 and a bath temperature of 60°C. A very adherent nickel deposit (0.005 mm.) is obtained that may be safely subjected to sharp bends and which satisfactorily protects the steel basis during the life of the lamp.

8-26. **Automatic Temperature Control in the Plating Shop.** *Sheet Metal Industries*, v. 21, Feb. '45, p. 261.

Description of temperature regulator illustrated which has been successfully used in a big shop, containing plating tanks of all types (nickel, copper, tin, zinc) and caustic and alkaline tanks.

8-27. **Analysis of Silver Plating Solutions.** J. N. Gregory and R. R. Hughan. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Feb. '45, pp. 109-113.

Methods for the electrometric determination of free cyanide and argenticyanide in silver plating baths are described. Both ions can be determined by the same run of the buret with silver nitrate solution. The end

points are detected by null-point readings on a galvanometer. The method requires inexpensive equipment and is very rapid and easy to carry out. The effect of other ions often found in electroplating solutions has also been investigated. 5 ref.

8-28. **Plating and Painting Switchboard Parts.** Fred M. Burt. *Products Finishing,* v. 9, March '45, pp. 24-26, 28, 30.

Approximately 30% of weight of material may be saved in the bus bars by increasing the conductivity through silver plating, with the added advantage of having closer, more secure and finer contacts between plated surfaces as compared with unplated contacts.

8-29. **A Rotating Cathode Cell for Strip Plating Evaluation and Control.** D. A. Swalheim. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 68-71.

Design of the duPont rotating cathode cell; examples of applications of the cell and of the results obtained; current-voltage characteristics; voltages required to produce 0.5, 0.75 and 1.0 lb. per base box tin plate; bath composition; relationships between voltage and current density at constant strip speed; effect of chloride concentration on voltage-current density relationship; effect of temperature on the voltage-current relationship; effect of tin content on cathode current efficiencies. 7 ref. (Presented at the 86th General Meeting, The Electrochemical Society.)

8-30. **Zinc Plating for Lubrication in Deep Drawing.** H. A. Shepard. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 85-86.

Bath operating conditions; economy in working necessary; filtration and agitation of electrolyte is important. (From American Electroplaters' Society *Monthly Review.*)

8-31. **Lead Plating.** O. Wright. *Metal Industry,* v. 66, March 2, '45, pp. 138-140.

Application to heavy duty bearings. Advantage claimed for this type of bearing is a reduction in "running-in" time.

8-32. **High-Speed Alkaline Tin Plating.** Martin M. Sternfels and Frederick A. Lowenheim. *Metal Finishing,* v. 43, March '45, pp. 100-101.

Potassium stannate solutions promise to overcome a major objection to alkaline tin plating—the inherently slow plating speed obtainable with the sodium stannate bath. It will do all the sodium stannate bath can do, and do it more quickly with the expenditure of less power. It possesses other minor advantages over the sodium bath as well, including greater freedom from sludge formation, better conductivity, and more favorable solubility relationships.

8-33. **A Simple Automatic Level Control for Plating Tanks.** Joseph B. Kushner. *Metal Finishing,* v. 43, March '45, pp. 102, 106.

The simple liquid level controller for plating and cleaning tanks described; proved of value in a number

of installations, particularly in gold plating work, but it is as readily useful wherever warm or hot solutions are employed for plating or cleaning.

8-34. **Chrome Plating of Piston Rings Increases Corrosion Resistance.** D. M. Smith. *American Machinist,* v. 89, March 1, '45, pp. 112-113.

Controlled plating of the face surfaces of rings extends their life three to four times. The plated rings are subjected to thorough laboratory inspection. Gives plant procedure.

8-35. **Plating Millions of Die Castings Economically.** *Die Casting,* v. 3, March '45, pp. 54-55, 58, 60, 62-63.

Copper, nickel, "Moly Black," gold and other finishes applied, especially on zinc alloys, but aluminum alloys are also given electrolytic and other coatings on a high production basis.

8-36. **Bright Zinc Plating.** S. Wernick. *Sheet Metal Industries,* v. 21, March '45, pp. 443-446.

Bright zinc plating; cadmium versus zinc plating; bright zinc plating processes; chemical control; electrolytic impurities; anodes. 7 ref.

8-37. **Electroplating: Modern Equipment and Technique.** H. Silman. *Sheet Metal Industries,* v. 21, March '45, pp. 467-475, 496.

Chromium plating. 12 ref.

8-38. **Economy of Chromic Acid in the Electrodeposition and Metal Finishing Industries.** *Sheet Metal Industries,* v. 21, March '45, pp. 494-495.

Main uses of chromic acid in the electrodeposition and metal finishing industries are: (a) Chromium plating; (b) anodizing; (c) non-electrolytic immersion treatments such as pickling and metal finishing. Possible ways in which the consumption of chromic acid in the above processes may be reduced are outlined.

8-39. **Superimposed AC on DC.** G. W. Birdsall. *Steel,* v. 116, March 12, '45, pp. 108-109, 120, 123.

Permits plating outputs to be doubled or tripled when used with newly developed metallo-organic solution additions; also affords improved covering power in recesses and a uniformly greater brilliance; thus makes available new levels of performance and economy in electrodeposition of zinc, cadmium and copper.

8-40. **Flash Chrome Plating.** C. L. Tanner, *Automobile Engineer,* v. 35, Feb. '45, pp. 67-68.

Hard chrome plating; extreme brittleness; flash plating process; reduced friction; applications to cutting tools; metal stampings; flash chrome effective as gage finish; applications to engine parts. (Presented before the American Society of Mechanical Engineers.)

8-41. **High Speed Nickel Plating.** W. L. Pinner and R. B. Kinnaman. *Monthly Review,* v. 32, March '45, pp. 227-234.

Development of a high speed dull, and a high speed bright nickel plating process permitting the commercial use of high current densities in decorative nickel plating. 4 ref.

8-42. **The Fundamentals of Chemistry for Electroplaters. XVII: Properties of Solutions.** Samuel Glasstone. *Monthly Review,* v. 32, March '45, pp. 253-255.

Boiling points and freezing points of solutions; molecular weights of electrolytes; theory of ionic dissociation; anions and cations.

8-43. **Stripping of Copper From Various Base Metals.** F. C. Mathers and C. E. Landwerlen. *Monthly Review,* v. 32, March '45, pp. 268-270.

Progress report number one; A.E.S. research project number 1. Bibliography of 56 items.

8-44. **Protective Value of Electro-Tin as an Undercoating.** S. Wernick. *Journal of the Electrodepositors' Technical Society,* Preprint, v. 20, 1944, pp. 47-60.

There is a marked improvement in corrosion resistance of a given deposit, whether this be zinc or cadmium and also, but not markedly, nickel, if the first thin layer of electrodeposit is substituted by a corresponding thickness of electrodeposited tin. Electrodeposited tin, as such, cannot adequately replace either of the electro-negative protective finishes which are commonly applied for rust preventing purposes, i.e., zinc or cadmium plating. If therefore, the tin undercoating does not improve the sacrificial function of the zinc deposit, the cause of its effectiveness must be sought for elsewhere. Electro-tin coating has a close-grained structure and thus results in the deposition of a layer of metal which is relatively freer from pores than a similar layer of either zinc or cadmium. The tin undercoating enables the deposit which is subsequently applied to be more uniformly distributed.

8-45. **Plating with Insoluble Anodes.** Walter R. Binai. *Metal Finishing,* v. 43, April '45, pp. 144-146, 170.

Insoluble anodes in acid copper solution; insoluble anodes in cyanide solution; silver replenishment-shot tower; electrolytic replenishment; trouble involved.

8-46. **Nomograph on Thicknesses of Electrodeposits.** Arthur S. Covert. *Metal Finishing,* v. 43, April '45, p. 147.

Designed to answer the questions most frequently met by the plater who wishes to deposit a given thickness of metal. Given the metal to be plated and the current density, it indicates the time required to deposit a given thickness or conversely the thickness achieved in a known time.

8-47. **The Cronak Process as Appied to Zinc Plate.** S. E. Maxon. *Metal Finishing,* v. 43, April '45, pp. 148-149.

Why and where it is used; general operations; use on zinc alloy die castings and rolled zinc; maintenance of solution; variables of the process; reasons for poor results; handling. 3 ref.

8-48. **Electrodeposition of Iron-Tungsten Alloys From an Acid Plating Bath.** M. L. Holt and Rodney E. Black. *Metal Finishing,* v. 43, April '45, pp. 150-153, 176.

Study of the electrodeposition of iron-tungsten alloys from a plating bath prepared by the addition of small

amounts of sodium tungstate to the ferrous ammonium sulphate bath to investigate the possibilities of electrodepositing tungsten alloys from commercial plating baths, modified by the addition of sodium tungstate. Main purpose is to obtain information which may lead to a better understanding of the process by which tungstates are reduced at the cathode during electrolysis, although the possible importance of electrodeposited tungsten alloys is not being overlooked.

8-49. **The Choice of Plated Coatings.** H. L. Farber. *Metal Finishing,* v. 43, April '45, pp. 154-155.

Some ten or twelve metals and alloys are in extensive commercial use as electroplated finishes. In addition many combinations and variations of these metals are being used to obtain coatings to meet special requirements. A number of factors are involved in determining the kind of metal to be deposited and the finishing system to be used, including the use to which the product is to be put, the base material to be finished, the cost of finish to be used and the facilities required.

8-50. **Electro-Plating on Aluminum.** *Aluminum and the Non-Ferrous Review,* v. 9, Oct.-Dec. '44, pp. 52, 54-55.

From an electrodeposition point of view, aluminum presents many intricate problems, but at the same time an enormous and ever-widening field of application. Methods which may be employed in the plating of aluminum and problems to be faced.

8-51. **Bright Zinc Plating.** S. Wernick. *Sheet Metal Industries,* v. 21, April '45, pp. 626-629.

Preparation of the cathode surface; advantages of bright zinc plating; electrolytic polishing of zinc; bright cadmium plating; acid electrolyte. 10 ref.

8-52. **Electroplating: Modern Equipment and Technique.** H. Silman. *Sheet Metal Industries,* v. 21, April '45, pp. 675-681.

Cadmium plating; plating solution; cadmium plating practice; effect of impurities; anodes; after-treatment of cadmium deposits; lead plating; types of baths; the fluoborate bath; some characteristics of the solution; addition agents; alternative baths; resistance to corrosion. 12 ref.

8-53. **Selecting Plated Coatings.** H. L. Farber. *Products Finishing,* v. 9, May '45, pp. 42-44, 46, 50, 52.

Factors involved in determining the kind of metal to be deposited and the finishing system to be used, including the use to which the product is to be put, the base material to be finished, the cost of finish to be used, and the facilities required.

8-54. **Science and Electroplating.** E. W. Cox. *Monthly Review,* v. 32, April '45, pp. 349-351.

Types of conductors; theory of electrolysis; throwing power.

8-55. **Nomograph for Determining Amperage and Time of Plating.** John S. Hart. *Monthly Review,* v. 32, April '45, pp. 359, 365.

Calculations for determining the time and current required to plate an article are tedious when carried out often, and errors are frequently made. To eliminate calculations and errors, nomograph has been worked out. Calculations of the current for and time of plating are based on area, current density, metal plated and bath efficiency, and thickness of deposit required.

8-56. **Analysis of Impurities in Plating Baths. Progress Report No. 1.** *Monthly Review,* v. 32, April '45, pp. 367-370.

A bibliography of modern methods of isolating and determining metallic impurities. References chosen which describe procedures most adaptable to nickel plating baths.

8-57. **Hard Chrome Plating.** N. N. Sawin. *Metal Industry,* v. 66, March 30, '45, pp. 202-204.

Review of current German practice. (Translated from "Metallwaren-Industrie u. Galvanotechnik.")

8-58. **Protective Coatings on Metals.** W. J. Blanch. Australian Institute of Metals: *Australasian Engineer Science Sheet,* Nov. 7, '44, pp. 11-16. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 130-A.

Descriptions are given of methods of plating steel and cast iron with cadmium, zinc, tin, nickel and chromium, and of spraying with aluminum, zinc and tin. Some weathering and corrosion resistance tests are also discussed.

8-59. **Palm Oil Recovery System.** H. P. Wilkinson. *Steel,* v. 116, April 23, '45, pp. 90-91, 112, 115.

In Weirton Steel Co.'s tin plate department; 25% reduction in purchases of new oil, savings in tin and improved quality of plate through elimination of "fish eyes" and other flaws are the results.

8-60. **Fluorescent Lamp Problems Challenge the Electrochemist.** Richard G. Slauer. Electrochemical Society Preprint 87-18, April 16, '45, 7 pp.

Theoretical; costs; fluorescent glass.

8-61. **The Fundamentals of Chemistry for Electroplaters, XVIII.** Samuel Glasstone. *Monthly Review,* v. 32, April '45, pp. 363-365.

Hydrolysis of salts.

8-62. **The Deposition of Metals From Fluoborate Solutions.** Harold Narcus. *Metal Finishing,* v. 43, May '45, pp. 188-190, 199.

Methods of procedure, operating conditions and characteristics of metal fluoborate baths, whose "concentrates" are commercially obtainable from several sources discussed. These include the lead and lead-tin alloy baths and the tin, cadmium, zinc and indium fluoborate solutions.

8-63. **Laboratory Control of Plating Operations.** *Metal Finishing,* v. 43, May '45, pp. 200-201.

Plant layout of Michigan Chrome and Chemical Co. which operates a complete plating plant including bright chromium, hard chromium, copper (rochelle

and high speed) cadmium, tin, silver, nickel, bronze and other metals.

8-64. **Plating With Up-to-Date Facilities at Adel.** Gerald Eldridge Stedman. *Metal Finishing,* v. 43, May '45, pp. 202-204.

Quality control in machining, processing and plating at the Burbank, Calif. plant of Adel Precision Products Corp.

8-65. **Electroforming.** A. H. Stuart. *Metal Industry,* v. 66, April 13, '45, p. 236.

The use of a semi-colloidal dispersion of graphite in water to form a film on wax for subsequent electrodeposition after waterproofing is recommended in this article. 2 ref.

8-66. **Nickel Plating.** *Metal Industry,* v. 66, April 27, '45, pp. 266-268.

Precautions necessary to insure a highly finished deposit. Various compositions of bath used. (Translated and condensed from *Metallwaren Industrie und Galvanotechnik.*) 3 ref.

8-67. **Iridite Treatment for Plated Parts.** J. Albin. *Iron Age,* v. 155, May 24, '45, pp. 44-50.

Zinc and cadmium, both basically good protective films on steel, are still actively capable of corroding. By forming a coat which keeps air and moisture away from the metal surface, Iridite protects the cadmium or zinc plate to a marked degree. Iridite corrosion resistant surfaces can be obtained in several colors and finishes.

8-68. **Method of Plating of Magnesium and Magnesium Alloys (German Patent No. 727619).** E. Hartmann. *Metall Wirtschaft,* v. 22, Nov. 20, '43, pp. 524-527.

8-69. **Indium Plating with Cyanide Caustic Bath.** J. B. Mohler. *Iron Age,* v. 155, May 31, '45, p. 47.

Use of potassium hydroxide in conjunction with potassium cyanide overcomes the difficulties normally encountered in bath preparation, halts bath decomposition and eliminates the necessity of aging the plating electrolyte before use.

8-70. **The Production of Machinable Chromium Deposits.** G. E. Gardam. *Electrodepositors' Technical Society Journal,* Preprint, v. 20, '45, pp. 69-74.

Devises means of depositing chromium in a form machinable by a cutting tool with a diamond pyramid hardness number of not more than about 400.

8-71. **Bright Zinc Plating, VI.** S. Wernick. *Sheet Metal Industries,* v. 21, March '45, pp. 443-446.

Bright zinc plating; cadmium vs. zinc plating; bright zinc plating processes; chemical control; electrolytic impurities; anodes. 7 ref.

8-72. **Pressing Technique as a Preliminary to the Production of Good Electrodeposits.** J. D. Jevons. Electrodepositors' Technical Society, *Journal,* Preprint, v. 20, '45, pp. 93-104.

Gives a short description of some of the defects or

conditions in metal sheet and strip which cause trouble during plating and of press shop operations and of how these influence the product from the viewpoint of the electrodepositor to whom they will be passed.

8-73. **The Influence of Anodes in Plating Processes.** S. R. Goodwin, G. M. Bechtold and H. A. Bechtold. Electrodepositors' Technical Society *Journal* Preprint, v. 20, '45, pp. 105-118.

Requisites of a good anode; purity; absence of polarization; uniform dissolution; plate anode; oval anode; ball anode; gear anodes; hooks; barrel anodes.

8-74. **Industrial Chromium Plating: Bath Composition, Control, and Supervision.** R. Bilfinger. *Metall Wirtschaft,* v. 22, Oct. 20, '43, pp. 467-471.

8-75. **A New Electrolyte for Rapid Silver Plating and Polishing Baths.** R. Weiner. *Metall Wirtschaft,* v. 22, Oct. 20, '43, pp. 472-474.

8-76. **Bright Nickel Plating.** Virgil H. Waite. *Monthly Review,* v. 32, May '45, pp. 467-469.

Brief review of the factors involved in the installation and operation of a bright nickel bath.

8-77. **The Principles of Acid-Base Analysis.** Samuel Glasstone. *Monthly Review,* v. 32, May '45, pp. 471-473.

Equivalence of acids and bases; equivalent weight of base; normal solutions; acid-base titration; choice of indicator.

8-78. **Rectification and Surface Hardening of Screw Threads by Electrodeposition.** *Machinery* (London), v. 66, May 3, '45, pp. 497-498.

Rectification of worn or over-machined threads; prevention of scoring; surface hardening by chromium deposition; application to screw gages.

8-79. **Screw Threads.** *Metal Industry,* v. 66, May 4, 45, p. 280.

Rectification and surface hardening by electrodeposition. Cost of a damaged component can be saved by electrolytic deposition of nickel or chromium. (From E.T.A.C. Technical Memorandum No. 2.)

8-80. **Electro-Brightening Copper and Silver, VII.** S. Wernick, *Sheet Metal Industries,* v. 21, May '45, pp. 844-853, 865.

Bright copper plating; electrolytic polishing of copper; bright silver plating; source of brightening in carbon disulphide electrolytes; bright deposits from acid solution; electrolytic polishing of silver; effect of free cyanide; effect of temperature; effect of stirring. 27 ref.

8-81. **Electroplating: Modern Equipment and Technique, VI.** H. Silman. *Sheet Metal Industries,* v. 21, May '45, pp. 859-865.

Cyanide bath; zincate bath; plating conditions; anodes; cleaning before plating; bright zinc plating; effects of contaminants; zinc-mercury bath; acid zinc plating; operating conditions; electro-galvanizing of wires. 27 ref.

8-82. **The Deposition of Metals from Fluoborate Solutions.** Harold Narcus. *Metal Finishing,* v. 43, June '45, pp. 242-244.

With the presence of tin fluoborate it is possible to conveniently and economically make up a suitable plating bath for the electro-deposition of alloys of lead and tin in various compositions. The resulting alloy deposit is hard and relatively bright. Also discusses cadmium baths; zinc baths; indium baths.

8-83. **Inspection Tests for the Adhesion of Electroplated Coatings With Particular Reference to the B.N.F. Adhesion Test.** A. W. Hothersall and C. J. Leadbeater. *Metal Finishing,* v. 43, June '45, pp. 245-246, 273-274.

B.N.F. adhesion test developed for use in the inspection of electroplated coatings. Designed to enable non-adherent or very slightly adherent coatings of ordinary commercial thickness (up to 0.002 in.) to be detected. Appears to have possible applications to coatings, both metallic and non-metallic, formed by other methods. Apparatus described. 4 ref.

8-84. **Machinable Chrome.** G. E. Gardam. *Metal Industry,* v. 66, May 11, '45, pp. 298-299.

Necessity for the production, for a specific purpose, of a chromium deposit capable of being machined by ordinary tools, led to the development of the solution and technique described. (Electrodepositors' Technical Society.)

8-85. **Nickel Plating.** *Metal Industry,* v. 66, May 11, '45, pp. 299-300.

Formation of bright and ultra-bright deposits. Details of the composition of some of the more recent baths used for bright nickel plating. (From *Metallwaren Industrie und Galvanotechnik,* 1943.)

8-86. **Electromotive-Force Measurements of Molten Binary Alloys.** Ralph A. Schaefer and Frank Hovorgka. Electrochemical Society Preprint, 87-23, 20 pp.

Potentials were measured in a reversible cell. Whenever intermetallic compounds exist in the solid state, the properties are more or less abnormal in the liquid state. This points to the fact that there probably is a definite relationship between Stewart's work on "cybotatic" state and the metallic solutions of the type studied.

8-87. **Chrome Plating Carbide Tipped Tools.** A. W. Ehlers. *Tool & Die Journal,* v. 11, June '45, pp. 98-100, 130.

Experiments with chrome plating of high speed tools indicate that specific applications such as taps, reamer and pilot bars, etc., do react favorably. Cyanide nitriding is, however, much more successful.

8-88. **The Fusion Brightening of Electrotinplate.** Howard T. Francis. *Frontier,* v. 8, June '45, pp. 6-7, 12.

Describes attempted experiments for the purpose of learning more about the several phenomena which occur during the few seconds in which the tin is in the liquid state.

8-89. **Specification Zinc Plating on Steel Sheets.** W. H. Safranek. *Monthly Review,* v. 32, June '45, pp. 567-578.

To maintain uniformity of plating, many factors influencing cathode efficiency were automatically controlled. Solution circulation was used as a means for maintaining uniform and constant concentration of solution. Automatic temperature control was used to operate motor valves regulating flow of water through cooling coils. Chemical additions were made on a continuous basis.

8-90. **Hard Chromium Plating.** J. J. Dale. *Monthly Review,* v. 32, June '45, pp. 581-594, 619.

Plating technique; operating characteristics of chromium plating baths; practical considerations; pre-treatments for various basis metals; use of hard chromium plate. 16 ref.

8-91. **Electroplating: Modern Equipment and Technique.** H. Silman. *Sheet Metal Industries,* v. 21, June '45, pp. 1031-1036.

Tinplating; the chloride bath; the stannate bath; anodes; caustic soda content; operation of the bath; the potassium stannate bath; the acid tin bath; acid tin sulphate bath; operating conditions; continuous electrotinning of steel strip; re-flowing procedure; relative merits of hot-dip and electrotinning.

8-92. **Stop-Off Devices Expedite Plating.** *Wings,* v. 4, July '45, p. 1651.

Application and removal of lacquers avoided and no drying is required, hence much time is saved. Quality is improved.

8-93. **The Electrodeposition of Element 43 and the Standard Potential of the Reaction Ma-MaO$_4$.** John F. Flagg and William E. Bleidner. *Journal of Chemical Physics,* v. 13, July '45, pp. 269-276.

Element may be obtained in an oxidized, anionic form by treatment with nitric and sulphuric acids.

8-94. **Indium Plating.** J. B. Mohler. *Metal Industry,* v. 66, June 22, '45, pp. 395-396.

Use of a high pH stabilized caustic-cyanide bath. 8 ref.

8-95. **The Repair of Worn or Over-machined Parts by Electrodeposition.** A. W. Hothersall. Institution of Mechanical Engineers *Journal,* v. 152, June '45, pp. 8-28.

Worn or over-machined parts may be restored to size by electrodeposition of nickel or chromium followed by machining or grinding to remove excess of deposit. Mechanical properties and the adhesion of these deposits are described with special reference to nickel. It is shown that strongly adherent nickel coatings can contribute appreciably to the tensile strength of the steel upon which they are deposited. Electrodeposited coatings may reduce the fatigue strength of steel and their use on parts subject to high alternating stresses should be made with caution. General notes on the process are given for the guidance of users.

8-96. **Reclaiming and Hardening of Engineering Components by Electrodeposition.** H. Merryweather. *Engineering,* v. 159, May 25, '45, pp. 419-420.
Chromium and nickel for electroplating.

8-97. **Plating of Die Castings on Full Automatic Conveyor.** H. A. Schoonover. *Metal Finishing,* v. 43, July '45, pp. 287, 305.
Description of conveyor and method employed.

8-98. **Anodes.** S. R. Goodwin and H. A. Bechtold. *Metal Industry,* v. 67, July 6, '45, pp. 10-12.
Manufacture of various types of anodes and their advantages and disadvantages. (From Electrodepositors' Technical Society).

8-99. **American Electroplaters' Society Project Number One on Stripping of Copper from Various Base Metals. Progress Report Number Two.** F. C. Mathers, C. E. Landwerlen, and E. L. Martin. *Monthly Review,* v. 32, July '45, pp. 672-679, 719.
Abstract of literature; chemical methods; electrochemical methods. 35 ref.

8-100. **Anodes.** S. R. Goodwin and H. A. Bechtold. *Metal Industry,* v. 67, July 20, '45, pp. 42-44.
Influence of anode characteristics in plating processes.

8-101. **Taming Hard-Shell Kirksite.** John W. Davis. *Wings,* v. 4, Aug. '45, p. 1673.
Chromium plating of soft-metal die surfaces lengthens their life in forming tough stainless-steel sheet for Superfortress parts. A special chemical stripping process now makes it possible to remove the plating locally for repairs without destroying the base metal.

8-102. **Estimation of Wetting Agent Concentration.** A B. Ashton and N. J. Stead. *Metallurgia,* v. 32, June '45, pp. 53-56.
Surface active materials, or wetting agents, have in recent years found increasing application in electroplating and allied processes. A reliable routine test is necessary and a method of estimating the amount of wetting agent present in the solution is described which is both rapid and simple.

8-103. **Peacetime Plating.** R. MacNair. *Metal Industry,* v. 67, Aug. 3, '45, pp. 74-76.
Refresher for those operators who have been engaged on dull finishes during the war. Draws attention to the bright finishes of peacetime. Plant and equipment for bright nickel and chromium.

8-104. **The Future of Electroplating.** C. B. F. Young. *Metal Finishing,* v. 43, Aug. '45, pp. 334-335.
Is there a future in it? Can it stand on its own?

8-105. **Plating of Plastics at Monroe Auto Equipment Company.** Bryant W. Pocock. *Products Finishing.* v. 9, Aug. '45, pp. 48-50, 52, 54, 56, 58, 62, 64.
Good plastic for plating must be smooth. Minute defects are magnified after plating and burnishing.

Second qualification is hardness. Process described consists of reduction of silver in the presence of tin and hydrochloric acid. When sprayed, the two metallizing solutions enter and leave the spray gun separately in such a manner that the two streams converge to meet and blend at the proper distance in front of the gun for convenient handling. 6 ref.

8-106. **Electroforming Suggested Technique.** Samuel Wein. *Products Finishing,* v. 9, Aug. '45, pp. 66, 68.

Methods commonly employed in electroforming.

8-107. **Some Factors in the Production of Electrolytic Tin Plate.** T. G. Timby. *Iron & Steel Engineer,* v. 22, Aug. '45, pp. 40-48.

Every step in the manufacture of plate and its subsequent coating influences the final product. Progress depends on investigation of the various phases and interchange of information.

8-108. **Tin Fusion by Radiant Tube Heating.** Howard L. Halstead. *Iron & Steel Engineer,* v. 22, Aug. '45, pp. 49-50.

Fusion of electrolytic tin plate by radiant tube heating gives a low fuel cost for the process, with quality comparable to that produced by other methods.

8-109. **Progress Report Number Two: A.E.S. Research Project Number 2 on Analysis of Impurities in Plating Baths.** G. Frederic Smith and Frederick Duke. *Monthly Review,* v. 32, Aug. '45, pp. 805-807, 810.

Aluminum; cadmium; calcium; chromic acid; copper; iron; lead; manganese; silica; zinc. 25 ref.

8-110. **Standby D. C. Battery System for Silver Plating.** D. L. Patrick. *Monthly Review,* v. 32, Aug. '45, pp. 793-794, 810.

To insure against current interruptions, a standby d. c. battery system devised that can be installed in conjunction with silver plating equipment and electrical circuits. Installation; operation; equipment and cost.

8-111. **Peacetime Plating.** R. MacNair. *Metal Industry,* v. 67, Aug. 17, '45, pp. 106-108.

Plant and equipment for bright nickel and chromium.

8-112. **Electronic Devices.** A. Korbelak. *Metal Industry,* v. 67, Aug. 31, '45, pp. 138-139.

Unusually large variety of metals and non-metals used in the manufacture of electronic devices has resulted in requests for the increased use of electrochemical methods in the processing of such materials. (The Electrochemical Society.) 9 ref.

8-113. **Peacetime Plating.** R. MacNair. *Metal Industry,* v. 67, Aug. 31, '45, pp. 139-140.

Plant and equipment for bright nickel and chromium.

8-114. **Is the Salt Fog a Test for a "Poor" Nickel Plate?** George B. Hogaboom. *Metal Finishing,* v. 43, Sept. '45, pp. 372-373.

Real value of the nickel deposit as a protective coating can be determined only by testing the nickel deposit itself in manner given.

8-115. **New Chrome Plating Method Boosts Life of Engine Parts.** D. P. Thornton. *National Petroleum News,* v. 37, Sept. 5, '45, pp. R-684-R-686, R-688.

"Porus-Krome" process produces surface filled with pockets and channels which retain lubricant and overcome chromium's usual lack of wettability. 7 ref.

8-116. **Quality Nickel Deposits Maintained by Continuous Solution Purification.** Bernard C. Case. *Monthly Review,* v. 32, Aug. '45, pp. 788-790.

Cobalt-nickel baths with details of recommended practices worked out. Purification in the make-up of new solutions. 4 ref.

8-117. **Etching Steel With Oxalic Acid Before Industrial Chromium Plating.** G. R. Makepeace. *Metal Finishing,* v. 43, Sept. '45, pp. 364-367.

New pre-treatment for "hard" chromium plating shows important advantages. Etching methods; requirements; oxalic acid etching; effect of variables; performance; advantages of oxalic acid.

8-118. **Chlornaphthalene Wax for Stopping-Off in Electrodeposition Practice—Its Advantages and Limitations.** C. W. Richards. Electrodepositors' Technical Society *Journal,* (Preprint), v. 20, '45, pp. 155-164.

Ideal stopping-off agent is one with good dielectric properties, satisfactory adhesion to the articles to be treated, resistance to all plating and cleaning solutions, ease of application and removal, capable of use at elevated temperatures, recoverable for re-use, non-inflammable and non-toxic. Type of material to be considered falls into the wax class.

8-119. **The Adhesion of Electrodeposits, I.** A. L. Ferguson and Elmer F. Stephan. *Monthly Review,* v. 32, Sept. '45, pp. 894, 897, 898, 901-902, 905-906.

Some of the papers in the bibliography are devoted practically entirely to a study of methods for measuring the adhesion of electrodeposits, some contain extensive information on this subject along with other material, but in more papers the subject of adhesion is merely incidental, and the only connection with adhesion may consist in stating the methods used.

8-120. **Electro-Tin—Protective Value as an Under-Coating.** S. Wernick. *Metal Industry,* v. 67, Sept. 28, '45, pp. 202-204.

Cadmium ordinarily deposits fairly uniformly on steel surfaces, but it was found that the proportion of metal which reached recesses in intricate shaped components was insufficient to provide the necessary protection even though the thickness of deposit applied was much increased above the normal. The provision of an electrotin undercoating from a solution, the throwing power of which was superior to that of the cadmium cyanide electrolyte, considerably improved the protective effect of the subsequent coating of cadmium.

8-121. **The Electrodeposition of Metals on Plastics.** Harold Narcus. Electrochemical Society, Preprint, 88-5, 45 pp.

Purposes of metallizing a plastic article are to render it a suitable substitute for critical and strategic metals and to produce a finished article which has the inherent properties of the plastic in addition to the desired properties of the deposited metal. By plating on a plastic its tensile,

impact, and flexural strength and its resistance to distortion from heat are increased and its water absorption is decreased. Because of the absence of electrolytic effects, due to basis metals that accelerate corrosion, a metallic coating on a plastic material is more resistant to corrosion than when applied to a basis metal. Thickness of the silver film is controllable and measurable using either the direct or the optical methods, preferably the former.

8-122. **Current Zinc Electroplating Practice.** Allen G. Gray. *Steel,* v. 117, Oct. 8, '45, pp. 108-109, 158, 161, 162, 164, 166, 170.
Character and life of plated coatings; acid and cyanide baths; bath formulas; operating conditions.

8-123. **Racking.** J. L. Vaughan and I. A. Usher. *Metal Industry,* v. 67, Sept. 14, '45, pp. 170-172.
In a consideration of the practical aspects of hard chromium plating problems, gives a description of the racks and plating fixtures developed for a variety of work. (From *Canadian Metals & Metallurgical Industries.*)

8-124. **Heating and Agitating Small Tanks.** P. J. Lo Presti and H. Bandes. *Metal Finishing,* v. 43, Oct. '45, pp. 406-407.
Reflector drying infra-red heat lamps as heaters for glass plating tanks.

8-125. **The Treatment of Magnesium and Magnesium Alloys.** George B. Hogaboom. *Metal Finishing,* v. 43, Oct. '45, pp. 408-410.
Amount of research done on protection of magnesium as evidenced by the number of patents issued. List of 87 patents is appended, with claims abstracted for 13 patents. These cover the most significant points of the surface treatment of magnesium and its alloys.

8-126. **Fundamentals of Science Relating to Electroplating.** *Metal Finishing,* v. 43, Oct. '45, pp. 410-411, 439.
Corrosion and its various forms.

8-127. **Electrolytic Methods of Polishing Metals. IX. Rhodium Plating.** S. Wernick. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1586-1592.
Electrolytes; comparison of sulphate and phosphate electrolytes; preparation of plating solutions; rhodium sulphate; rhodium phosphate; complex rhodium electrolyte. 11 ref.

8-128. **Current Zinc Electroplating Practice.** Allen G. Gray. *Steel,* v. 117, Oct. 22, '45, pp. 129-130, 132, 134.
Fundamental chemistry of cyanide type zinc baths and data on the zinc-mercury process and "bright" zinc plating.

8-129. **Current Zinc Electroplating Practice.** Allen G. Gray. *Steel,* v. 117, Oct. 29, '45, pp. 110, 112, 114, 146.
Cyanide plating solution control and maintenance and preparation of base metals are discussed. 7 ref.

8-130. **The Adhesion of Electrodeposits, II. General Considerations.** A. L. Ferguson and Elmer F. Stephan. *Monthly Review,* v. 32, Oct. '45, pp. 1006-1015, 1018-1021.
Force involved in adhesion; perfect adhesion is not an absolute quantity; meaning of degree of adhesion and per-

fect adhesion; highest type of bond between deposit and base metal; polished versus etched surfaces for better bonding.

8-131. **High Speed Zinc Plating.** A. E. Carlson and M. J. Krane. *Monthly Review,* v. 32, Oct. '45, pp. 1022-1026.

Uniformity of both finish and quality and more positive control of coating thicknesses, which are possible with the electrolytic process, offer advantages over the hot dipping method. High current efficiency, high limiting current densities and low resistivity of improved modern electrolytic acid processes favor high speed production and lowered operating costs. Baths of fluoborate electrolytes possess promising high speed plating possibilities. Exploration of the zinc compound has resulted in the development of a bath which offers new advantages.

8-132. **Electricity for the Plater, III.** D. A. Cotton. *Products Finishing,* v. 10, Oct. '45, pp. 66-68, 70, 72, 74.

Consideration of concrete applications of Ohm's law, after discussing some of the factors in electric circuits, such as series and multiple or parallel connections.

8-133. **Thiourea in Acid Copper Plating Solutions.** Walter Brenner and C. B. F. Young. *Products Finishing,* v. 10, Oct. '45, pp. 76, 78, 80, 82, 84, 86, 88, 90.

Presents a comprehensive discussion of the effect of thiourea when used in acid copper plating solutions. 5 ref.

8-134. **Current Zinc Electroplating Practice—V.** Allen G. Gray. *Steel,* v. 117, Nov. 5, '45, pp. 142, 144, 182, 184, 186.

Shows how to test quality of electrodeposited zinc coatings. 19 ref.

8-135. **Plating of Plastics.** B. W. Pocock. *Metal Industry,* v. 67, Oct. 12, '45, pp. 234-235.

Suggests that the main improvement in the process which has yet to be discovered is the development of a plated metallic coating as elastic as rubber.

8-136. **Electro-Tin.** S. Wernick. *Metal Industry,* v. 67, Oct. 12, '45, pp. 235-236.

Discussion of the results and the practical applications of the process. It has been found that an undercoating of tin eases the subsequent zinc or cadmium plating of castings.

8-137. **Chlornaphthalene Wax.** C. W. Richards. *Metal Industry,* v. 67, Oct. 26, '45, pp. 266-268.

Advantages and limitations for stopping-off. (Electrodepositors' Technical Society.)

8-138. **Electroplated Plastics.** E. E. Halls. *Plastics,* v. 9, Oct. '45, pp. 504-511.

Study of the Metaplast patents and of recent technical publications presented.

8-139. **Current Zinc Electroplating Practice.** Allen G. Gray. *Steel,* v. 117, Nov. 12, '45, pp. 132, 134, 136.

Chromate, anodic and phosphate types of protective coatings for zinc plated surfaces are discussed. 11 ref.

8-140. **The Fundamentals of Chemistry for Electroplaters, Part XXII.** Samuel Glasstone. *Monthly Review,* v. 32, Nov. '45, pp. 1099, 1101, 1103.

Electrons and valence.

8-141. **The Adhesion of Electrodeposits, III.** A. L. Ferguson and Elmer F. Stephan. *Monthly Review,* v. 32, Nov. '45, pp. 1116-1118, 1121-1122, 1125-1126, 1129-1130, 1135, 1136, 1139, 1140, 1143, 1144, 1147, 1148, 1151, 1152.

Correlated abstract of published methods for measuring the degree of adhesion.

8-142. **Metal Finishing at Toledo's DeVilbiss Company.** Bryant W. Pocock. *Products Finishing,* v. 10, Nov. '45, pp. 40-42, 44, 46, 48, 50, 52.

Metals commonly electrodeposited at DeVilbiss include gold, silver, rhodium, tin, cadmium, zinc, nickel, copper and chromium; plating solutions; determinations and methods of control.

8-143. **Electricity for the Plater. Part IV.** D. A. Cotton. *Products Finishing,* v. 10, Nov. '45, pp. 66, 68, 70, 72, 74.

Deals with effect of temperature upon resistance of conductors and its related effects.

8-144. **Speculum Plating and Its Uses.** John Ireland. *Materials & Methods,* v. 22, Nov. '45, pp. 1400-1402.

Chemical composition of deposit is about 45% tin and 55% copper, but properties of the alloy coating are quite different from either of the constituent metals. In appearance coating has color of silver, hardness is intermediate between that of nickel and chromium and it has high resistance to corrosion and tarnish.

8-145. **Chromium Plating of Cutting Tools.** Edwin H. Halvorsen. *Tool Engineer,* v. 15, Nov. '45, pp. 43-44.

Methods outlined increase tool life and provide for closer control of surface and dimensional quality.

SECTION IX

PHYSICAL AND MECHANICAL TESTING

9-1. **Testing Speed Specifications.** George C. Ernst and LeRoy W. Empey. American Society for Testing Materials *Bulletin* no. 131, Dec. '44, pp. 31-33.

Action of testing machines during test; convenience of application.

9-2. **Fatigue Testing Apparatus.** *Aircraft Engineering,* v. 16, Nov. '44, pp. 334-335.

Fatigue failure may, in practice, result from alternating push-pull, bending or torsional stresses. Testing machines described and illustrated.

9-3. **Resonant Fatigue Tests.** *Western Metals,* v. 2, Dec. 44, pp. 54-56.

New field in fatigue and repeated load tests. Major advantages resulting are simplicity, test data of greater uniformity and value, and substantial savings in time and money in making the necessary setups as well as conducting tests.

9-4. **The Technical Cohesive Strength of Metals in Terms of the Principal Stresses.** D. J. McAdam. *Metals Technology,* v. 11, Dec. '44, pp. 5-31.

Technical cohesive strength of brittle metals; influence of notch angle, notch depth, and root radius on strength and ductility of metals; technical cohesive strength of ductile metals. 12 ref.

9-5. **Hardness Tester With Automatic Certification Stamp.** Adolph Vlcek. *Metal Progress,* v. 47, Jan. '45, p. 95.

To combine the testing and stamping operations into an automatic cycle, a fixture for a standard tester is shown.

9-6. **Fatigue Failures May Be Blamed on You.** H. A. Bolz. *Modern Machine Shop,* v. 17, Jan. '45, pp. 142, 144, 146, 148, 150.

Gives natures and causes of preventives and remedies for fatigue failures.

9-7. **Dependence on Stress of Damping Capacity of Alloys.** Andrew Gemant. *Mechanical Engineering,* v. 67, Jan. '45, pp. 33-38.

Stress dependence of the damping capacity of alloys. 14 ref.

9-8. Relaxation Methods Applied to Engineering Problems, X. The Graphical Representation of Stress. D. N. De G. Allen, and R. V. Southwell. *Royal Society Proceedings,* v. 183, Nov. 30, '44, pp. 125-134.

Class of problem having importance in various branches of mathematical physics, and special importance in the theory of elasticity. Its worked examples all relate to the representation of stress, but it has much wider application. 5 ref.

9-9. Tensile Properties of Longitudinally Welded Plate. Leon C. Bibber. *Steel,* v. 116, Jan. 15, '45, pp. 80-84, 86, 129-130, 132-133.

Details of tests on full size specimens designed to simulate constructions found in welded steel ships in an effort to learn more about factors involved in cracking and breaking of welded ships. (Presented before the Society of Naval Architects and Marine Engineers.)

9-10. Fatigue and Tensile Test Specimens Prepared by Grinding. *Iron Age,* v. 155, Jan. 18, '45, p. 57.

Grinding machines equipped for preparing specimens for use in the laboratory. R. R. Moore standard fatigue specimens have the radius ground on a No. 13 universal and tool grinding machine.

9-11. Applying Fatigue Test Data in Design. Joseph Marin. *Machine Design,* v. 17, Jan. '45, pp. 143-146, 200, 202.

Use of fatigue test data in determining the size of members subject to alternating stresses; discusses the interpretation of these fatigue test results and applies these results to the design of machine members. 6 ref.

9-12. A Note on Bending Beyond the Proportional Limit. M. Yachter. *Journal of the Aeronautical Sciences,* v. 12, Jan. '45, pp. 21-30, 84.

Following problem solved: Assuming the principle of minimum strain energy to be valid over the entire range of the stress-strain curve, find the exact stress distribution over the depth of a beam in pure bending (or combined bending and axial load, provided strain energy due to axial load and beam column effects are neglected) compatible with equilibrium and minimum strain energy. 2 ref.

9-13. Mechanical Properties of Magnesium-Alloy Tubing. R. T. Schwartz and G. M. Martell. *Journal of the Aeronautical Sciences,* v. 12, Jan. '45, pp. 31-38.

Mechanical properties of extruded round, seamless magnesium-alloy tubing, containing 6.55% aluminum, 1.04% zinc and 0.30% manganese, which analysis is similar to that for Dowmetal J and AMC 57S. The tubing was characterized by a low ratio of proportional limit to ultimate strength in tension and a low proportional limit and yield strength in compression compared to those in tension. The tensile and compressive testing presented certain difficulties because of low shear resistance and sensitivity of the material to stress concentration. The marked difference between the stress-tangent modulus data for tension and com-

pression and the correlation of the latter with column properties for knife-edge and flat end conditions are emphasized. Torsional properties were also determined. 7 ref.

9-14. **Fatigue Strength of Butt Welds in Ordinary Bridge Steel—Maximum Stress Compressive.** *Welding Journal,* v. 24, Jan. '45, pp. 7s-9s.

Four groups of tests were planned with stress cycles as follows: (1) Zero to compression; (2) compression to tension one-fourth as great; (3) compression to tension one-half as great; (4) compression to tension three-fourths as great. Three specimens were tested on each of the above cycles with a maximum compressive stress of 32,000 psi. The remaining specimens were tested at the stresses necessary to obtain the data for S-N curves of the various cycles between 100,000 and 2,000,000 cycles. Findings given of greatest interest to designers.

9-15. **Fatigue Tests at Resonant Speed.** R. E. Rawlins. *Metal Progress,* v. 47, Feb. '45, pp. 265-267.

Possibilities of resonant systems for setting up rapidly alternating stresses when called upon to test a new type of coupling. Object was to determine whether or not they would loosen under repeated reversals of a minor load.

9-16. **Stage for Hardness Surveys.** W. W. Sopher. *Metal Progress,* v. 47, Feb. '45, pp. 271-272.

Description of special anvil devised to take the place of the conventional type used on the Rockwell machine.

9-17. **Rockwell Hardness (Diamond Penetrator) of Cylindrical Specimens.** W. L. Fleischmann and R. S. Jenkins. *Metal Progress,* v. 47, Feb. '45, pp. 275-277.

Rockwell hardness measurement on a cylindrical surface is not the same as on the flat. To take Rockwell measurements on cylindrical surfaces it is necessary to establish a correction which would correlate the hardnesses taken on the two. Procedure outlined.

9-18. **New Machines for Creep and Creep-Rupture Tests.** M. J. Manjoine. American Society of Mechanical Engineers, *Transactions,* v. 67, Feb. 45, pp. 111-116.

Describes two new creep-rupture machines. To illustrate the satisfactory operation of these machines, the results of creep-to-rupture tests on a cast 25% Cr, 12% Ni alloy are presented. The data from these tests are summarized in "design curves" which serve to describe the behavior of a material at a given temperature. 7 ref.

9-19. **Fatigue Testing of Bearing Alloys.** P. G. Forrester and B. Chalmers. *Engineering,* v. 159, Jan. 19, '45, pp. 41-43.

Machines built for testing an important property of bearing alloys; the resistance to fatigue failure under various conditions. They are now being used to test a wide range of alloys. The results can not by themselves be considered to determine the liability of a bearing to fatigue failure under service conditions.

9-20. **Specifying Dynamic Balance, IV.** W. I. Senger. *Machine Design,* v. 17, Feb. '45, pp. 163-166, 196.

Establishes certain features which must be present in balancing equipment if it is to perform its function properly. Requirements.

9-21. **Increasing Fatigue Life of Heat Treated Gears.** *Iron Age,* v. 155, March 1, '45, p. 63.

Increase the resistance to fracture of the teeth of gears by following measures: 1. Chamber at the shoulder of the teeth increased. 2. Thickness of the rim altered. 3. Grooves caused by grinding and polishing in the tooth gullet removed, the marks of the final polishing running at right angles to the teeth.

9-22. **Wheels of Worth.** L. K. Sillcox. *Scientific American,* v. 172, March '45, pp. 165-166, 168.

An abbreviated consideration of the effects of heavy stresses and strains on both wheels and rails. How much wheel area touches the rail?

9-23. **Air Hardenability of Steel.** C. B. Post, M. C. Fetzer, and W. H. Fenstermacher. *Steel,* v. 116, March 5, '45, pp. 120-121, 132, 134, 136, 139.

Data originally prepared for the American Society for Metals can be used by toolmakers and heat treaters in the selection of air hardening steels. New method of testing described.

9-24. **A New Machine for Measuring Wear Resistance of Walkway Materials.** A. W. Cizek, D. H. Kallas and H. Nestlen. American Society for Testing Materials *Bulletin,* no. 132, Jan. '45, pp. 25-28.

The wear test machine in its present form offers a high degree of versatility in so far as the factors such as speed, amount of lift of specimen, amount of abrasive, size and kind of abrasive, material on the face of the abrasion disk, ratio of specimen shaft speed to abrasion disk speed, size of the specimen, configuration of the specimen, and load on the specimen, can be varied independently to give the combination of conditions most closely approximating actual service. 7 ref.

9-25. **A Suggested New Parameter for Fatigue Strength Analysis.** Victor Seliger. American Society for Testing Materials *Bulletin,* no. 132, Jan. '45, pp. 29-31.

A new parameter, K_{fg} cos R, is suggested for use in the presentation of fatigue strength properties and in the analytical development of fatigue strength theory. Its advantages and possible limitations are discussed in the light of presently available data. The need for more developments such as this is emphasized.

9-26. **Relationships Between the Magnitude of the Notched-Bar Toughness and the Type of Fracture in the Bend Test on Weld Metal.** K. Albers. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 87, Oct. 30, '43, pp. 677-682. Iron and Steel Institute *Bulletin,* no, 109, Jan. '45, p. 85-A.

The value of the notched-bar impact test and of the bend test on weld metal as methods of determining the weldability of structural steels is discussed. Impact tests were carried out on specimens which had been subjected to various degrees of cold work, but no

relationship was found between the impact values and the type of fracture obtained in the bend test on weld metal.

9-27. **The Sphere of Application for Microhardness Testing.** E. B. Bergsman. *Teknisk Tidskrift,* v. 74, Nov. 11, '44, pp. 1297-1303. (In Swedish.) Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 86-A.

The applications of scratch and indentation microhardness testing machines are reviewed. It is shown that the ratio of the number of cracks round the impression to the impression area or depth can be used as a measure of the brittleness of the material tested.

9-28. **Bending of Curved Thin Tubes.** Leon Beskin. *Journal of Applied Mechanics,* v. 12, March '45, pp. A1-A7.

Stress distribution in curved tubes, and its influence on the rigidity, are examined in the case when the ratio of the radius of the center line to the radius of the tube is great. It is shown that, when this ratio is small, the results relative to rigidity remain fairly accurate, while the results relative to stress distribution are incorrect and require a more complete analysis.

9-29. **Yielding and Fracture of Medium Carbon Steel Under Combined Stress.** E. A. Davis. *Journal of Applied Mechanics,* v. 12, March '45, pp. A13-A24.

Results of combined stress tests on a medium carbon steel are presented. Particular attention has been paid to the magnitude and the distribution of the stresses and strains at the instant preceding fracture. The effect of the shape of the test specimen and the isotropy of the material upon the rupture properties has also been investigated.

9-30. **A New Design Criterion for Wire Rope.** D. C. Drucker and H. Tachau. *Journal of Applied Mechanics,* v. 12, March '45, pp. A33-A38.

Indicates that a dimensionless bearing-pressure variable $B = 2T/UdD$ is of prime importance in the proper choice of wire rope. Its significance is evident in the plot of life (number of cycles to failure) against this bearing-pressure ratio B, which shows a well-defined curve for several ordinary lay 6x37 ropes. Also, the scatter in test results for many different ordinary lay ropes of 6x19 and 6x37 construction is less than might be expected from the considerable variation in testing procedure and the wire rope itself. 14 ref.

9-31. **Shear Strength of Copper Brazed Joints.** N. L. King. *Iron Age,* v. 155, March 8, '45, p. 71.

Tests and results briefly outlined.

9-32. **Impact Resistance vs. Hardness of Aircraft Low Alloy Steels.** John M. Thompson. *Iron Age,* v. 155, March 8, '45, pp. 72-74.

A definite relationship between resistance to impact and hardness for SAE X4130, 4140, and X4340 steels is established on the basis of empirical data. Effects of various heat treatments on salt quenched and oil quenched materials compared.

9-33. **The Influence of the Magnitude of Cross-Sectional Area on Fatigue Strength.** W. Buchmann. *VDI Zeitschrift,* v. 87, no. 21/22, May 29, '43, pp. 325-327. *Engineers' Digest* (American edition) v. 2, March '45, pp. 136-137.

Influence of the "scale factor," i.e., the influence of the magnitude of cross-sectional area on fatigue strength as test samples have, generally, lesser dimensions than the actual parts. With steel, the flexural fatigue strength of a rod 100 mm. diameter is about 60% of that for a rod of 15 mm. Tests on light metals; scale factor and stabilizing effect.

9-34. **Deformation and Strength of Metals Subjected to Long-Period Stress.** A. Thum and K. Richard. *Zeitschrift des VDI,* v. 87, no. 33/34, Aug. 21, '43, pp. 513-520. *Engineers' Digest* (American edition), v. 2, March '45, pp. 130-133.

Creep properties; strength characteristics in the creep range; the deterioration characteristic; the notch effect; short period tests.

9-35. **Effect of Vibration on Brackets, Fastenings.** A. M. Wahl. *Machine Design,* v. 17, March '45, pp. 141-146.

Fatigue strength of screw fastenings for bracket-mounted overhanging loads has been found to be a limiting factor in design. This is because the flexibility of the bracket rim imposes flexural stress on the fastenings, resulting in early failure. (Abstract of American Society of Mechanical Engineers report.)

9-36. **The Biaxial Fatigue Strength of Low-Carbon Steels.** George K. Morikawa and LeVan Griffis. *Welding Journal,* v. 24, March '45, pp. 167s-174s.

Thin-walled cylindrical specimens of structural steel have been investigated in welded and unwelded forms, and in annealed and normalized states, under cyclic combined tensile stresses, and with various constant principal stress ratios of circumferential stress to axial stress from 0 to 2. Fatigue data are presented which show that there is only slight effect of principal stress ratio upon the endurance limit for this S.A.E. 1020 steel. 4 ref.

9-37. **The Overstrain of Tubes by Internal Pressure.** W. R. D. Manning. *Engineering,* v. 159, Feb. 9, '45, pp. 101-102.

Describes an approximate method of non-elastic straining applied to cylindrical sections where the degree of deformation is large and touches briefly on the mechanism of rupture in cylinders in the light of this theory.

9-38. **The Yielding Phenomenon of Metals, II.** Georges Welter. *Metallurgia,* v. 31, Feb. '45, pp. 207-212.

Influence of speed and loading conditions.

9-39. **Creep Phenomena in Steels at Room Temperature.** A. Pomp and A. Krisch. *Mitteilungen aus der Kaiser Wilhelm Institut für Eisenforschung,* v. 16, 1943, pp. 59-69. *Nickel Bulletin* (London), v. 18, Feb. '45, pp. 23-24.

Condensed review of creep investigations made at

room temperature, on non-ferrous materials and tests on various steels. Structure of the respective steels illustrated by a series of photomicrographs.

9-40. **True Stress-True Strain Diagrams—I.** *Metal Industry*, v. 66, March 16, '45, pp. 165, 168.

Application to the measurement of work-hardening characteristics. 3 ref.

9-41. **Fatigue Failure in Shear Panels of Aluminum and Magnesium Alloys.** E. R. Schenkel. *Product Engineering*, v. 16, April '45, pp. 222-225.

Comparison of the shear fatigue life of aluminum and magnesium alloy panels fabricated with various types of rivets used by the aircraft industry. Results are presented in chart form to allow the designer to evaluate quickly the fatigue characteristics of these rivet and alloy combinations in certain applications.

9-42. **Relation Between Hardness and Other Mechanical Properties.** T. H. Gray. *Product Engineering*, v. 16, April '45, pp. 236-240.

Non-destructive hardness testing, employed in evaluating other mechanical properties, is discussed and formulas and graphs are given which will assist in the fuller utilization of this test. Practical examples illustrate its use in design and shop practice.

9-43. **Determination of Crankshaft Stresses in Critical Regions With Damping.** J. Geiger. *Automotive Industries*, v. 92, April 1. '45, pp. 28-32.

In determining the incremental stresses in the critical regions, the point of application of the damping force is vitally important, as well as the point of application of the exciting force. With high effective damping, when the amplification is less than three times the static deflection, a corresponding correction must be made in the incremental stresses determined from torsiograms taken at the free end of the shaft. (Translated from *Automobiltechnische Zeitschrift.*)

9-44. **Definitions of Tensile Properties, II.** *Industry and Welding*, v. 18, April '45, pp. 40-41.

Proportional limit; elastic limit; proof stress.

9-45. **The Overstrain of Tubes by Internal Pressure.** W. R. D. Manning. *Engineering*, v. 159, March 9, '45, pp. 183-184.

Theory appears to throw some light on the actual way in which a cylinder of ductile material fails. While the pressure is too low to cause overstrain at any point in the tube wall, the tangential stress is highest at the inner surface, as also is the radial stress. As the pressure is raised, the elastic limit is first reached on the bore surface and the overstrain spreads outwards from the bore across the wall. As it does so, it causes the tangential stress to fall in the inner layers and to increase rapidly in the outer.

9-46. **Improved Methods for Calculating Torsional Vibration, II.** Robert H. Scanlan. *Machine Design*, v. 17, May '45, pp. 141-144.

For calculating higher modes of torsional vibration, three possible methods discussed. 8 ref.

9-47. **Beam Design in the Curvilinear and Plastic Ranges of Stress.** A. Fisher. *Metallurgia,* v. 31, March '45, pp. 241-247.

Interest is being shown in the differences between practical results and present theory as applied in the plastic ranges of stress. Discusses some basic principles of curvilinear-stress-strain characteristics and emphasizes a general feeling that the time is ripe for a re-examination of the bending and torsional theories, particularly the former. 8 ref.

9-48. **The Yielding Phenomenon of Metals, III.** Georges Welter. *Metallurgia,* v. 31, March '45, pp. 263-268.

Influence of speed and loading conditions.

9-49. **Relation Between Life Testing and Conventional Tests of Materials.** R. E. Peterson. American Society for Testing Materials *Bulletin,* no. 133, March '45, pp. 9-16.

Fundamentals of life testing; fatigue problem; creep of metals.

9-50. **The Influence on Tensile Strength of the Inclination of Weld-Seams to the Direction of Loading.** H. Zschokke and R. Montandon. *Schweizer Archiv,* v. 10, no. 5, 1944, pp. 129-137. *Engineers' Digest* (American Edition), v. 2, April '45, pp. 191-194.

To find experimentally for various seam efficiencies, that angle of inclination of the seam which results in the greatest static tensile strength.

9-51. **Effect of Bead Contour on Fatigue Life of Arc Welds.** George W. Harvey and Harry Campbell. *Product Engineering,* v. 16, May '45, pp. 306-307.

Fatigue failures were found to occur in arc welded lap joints of stainless steel after short periods of service. Weld beads having an abrupt change of section or sharp radius at the foot of bead had low fatigue life. The rewelding of beads by atomic hydrogen produces a more gradual slope of the weld bead and increases fatigue life.

9-52. **Shear and Tension Loads on Countersunk Bolts and Screws.** T. Rieben. *Product Engineering,* v. 16, May '45, pp. 308-313.

Discussion of allowable shear loads in single and double-lap joints, the effect of bolt or screw head bearing in joint tension, and allowable tension loads on nuts. Results are presented in tabular form and an analysis is made of the types of countersunk bolt and screw failures.

9-53. **Notch Fractures.** *British Steelmaker,* v. 11, April '45, pp. 156-163.

Judgment by fracture.

9-54. **Stresses and Deflections in Crankshafts Used in Mechanical Presses Revealed by Graphic Analyses.** Henry A. Weyer. *Modern Industrial Press,* v. 7, April '45, pp. 22, 24, 44.

Study of press failures due to breakage of crankshafts.

9-55. **A Study of the Tensile Properties of Heavy, Longitudinally Welded Plate Specimens Simulating Deck and Shell Joints.** Leon C. Bibber. *Welding Journal,* v. 24, April '45, pp. 193s-226s.

Observes the mode and extent of flow in ordinary commercial heavy mild steel plates of known tensile properties in the form of specially shaped, welded and variously conditioned tensile specimens. 3 ref.

9-56. **The Notched-Bar Impact Test.** John H. Hollomon. *Welding Journal,* v. 24, April '45, pp. 230s-244s.

Behavior of notched impact specimens. The effects of strain rate, temperature and stress distribution, which are discussed with reference to the impact specimen, apply just as well to the behavior of metal at the bases of notches in any engineering structure. Purpose of study is accomplished by correlating the results of the impact tests with those of tensile tests obtained at various low temperaures and high strain rates. 29 ref.

9-57. **Testing Speed Specifications.** George C. Ernst and Leroy W. Empey. *Iron & Steel,* v. 18, April '45, pp. 116-118.

Influence of rate of loading on tensile and elastic properties. 4 ref. (From *A.S.T.M. Bulletin.*)

9-58. **Theory of Bending, Torsion and Buckling of Thin-Walled Members of Open Cross-Section.** Stephen P. Timoshenko. Franklin Institute *Journal,* v. 239, April '45, pp. 249-268.

Mathematical discussion.

9-59. **Fatigue Failures of Aircraft Parts—Their Cause and Cure.** Daniel M. Davis. *Automotive Industries,* v. 92, May 1, '45, pp. 34-37, 67-68, 72, 74.

Major factors limiting the life of parts subjected to repeated loading are stress concentration, deflection and vibration. Effects of stress concentration generally may be evaluated in terms of three diffrent parameters described.

9-60. **Hardenability Behavior of Carburizing Grades of NE and Automotive Alloy Steels.** A. S. Jameson. *Steel,* v. 116, May 7, '45, pp. 110-114, 116, 118, 120, 192.

Difficulties encountered in testing for hardenability discussed and attention is drawn to differences to be expected in behavior of various alloy combinations.

9-61. **What About Your Test Bars?** *Foundry,* v. 73, May '45, pp. 84-87, 150, 153, 156.

Methods of machining and threading test bars highly important; careless pouring of test bars cuts apparent strength markedly; reproducibility of methods needed in testing and manufacturing.

9-62. **The Effect of the Steel on the Life of Gudgeon Pins.** E. Mickel and P. Sommer. *Archiv für das Eisenhüttenwesen,* v. 17, March-April, '14, pp. 227-234. Iron & Steel Institute *Bulletin* no. 111, March '45, p. 137-A.

A statistical analysis of the causes of the failure of gudgeon pins is presented and their relative importance is discussed. An examination of over 100 failures and the result of fatigue tests in compression indicated that the life of gudgeon pins made of many different alloy steels is approximately the same. The two main causes of failure are slag inclusions and faulty heat treatment. Sand blasting or grinding the inner surface of a pin increases the fatigue strength. While the magnetic powder method is an excellent way of examining the outer surface, there is no really suitable method of testing the inner surface.

9-63. **Fatigue Testing Methods and Equipment.** H. W. Foster and V. Seliger. *Mechanical Engineering,* v. 66, Nov. '44, pp. 719-725. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 137-A.

The more important considerations in the general design of fatigue testing apparatus, and the methods and equipment developed and now in use at Lockheed Aircraft Corp. are discussed in detail.

9-64. **The Creep of Heat Resisting Steels at Temperatures of 800 to 1200° C.** E. Siebel and G. Hahn. *Archiv für das Eisenhüttenwesen,* v. 17, March-April, '44, pp. 211-220. Iron & Steel Institute *Bulletin,* no. 111, March '45, pp. 137A-138A.

An investigation of the creep strength of heat resisting steels is described. The steels tested included three chromium steels (with 6%, 16%, and 23% chromium respectively), a 23-18 chromium-nickel steel, a steel containing 5% aluminum, 9% chromium and 1% titanium, and one containing 18% manganese, 9% chromium and 1% nickel. A special test apparatus was constructed in which hollow specimens with a gage length of 80 mm., an outside diameter of 8.7 mm. and an inside diameter of 3.5 mm. were heated by their own resistance by a heavy current to temperatures up to 1200° C. for periods up to 1650 hr. A comparison of the loads required to cause a total creep of 1% at 1000° C. in the ferritic steels after 1000 hr. showed a greater superiority of the chromium-aluminum steel; at 900° C. the manganese-chromium steel gave the highest value. Previous treatment of the 16% chromium steel at 1000° C. for 500 hr. increased the creep strength at 900° C. by 250%. The fractures of the austenitic steels were intercrystalline, whatever the temperature and load, while those of the ferritic steels were mostly transcrystalline.

9-65. **On Fatigue Failure Under Triaxial Static and Fluctuating Stresses and a Statistical Explanation of Size Effect.** F. H. Fowler. American Society of Mechanical Engineers *Transactions,* v. 67, April '45, pp. 213-216.

Purpose is to develop a framework for establishing a criterion of safe fatigue characteristics of manufactured units. In addition a statistical theory of fatigue has been indicated. Provision can be made for a study of combined stresses, static and vibratory stresses, and variations in amplitude. Interesting explanations of scale effect and stress gradient effect are given.

9-66. **Self-Indicating Torsion Testing Machines.** *Engineering,* v. 159, April 6, '45, p. 267.

Torsion testing machines embody an interesting utilization of the principles of the compound lever weighing machine, to measure the torque in the test piece set up by the straining gear. Two types of machine described.

9-67. **Influence of Clamping Effect on the Fatigue Behavior of Work-hardened Ductile Aluminum-Copper-Manganese Alloys.** Heinrich Cornelius. *Zeitschrift für Metallkunde,* v. 36, May '44, pp. 101-105.

9-68. **Behavior of Special Heat Resistant Alloys Under Creep Test at 620° C.** Eberhard Both. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 149-152.

9-69. **The Velocity of Propagation of Brittle Cracks in Steel.** M. Greenfield and G. Hudson. National Academy of Sciences *Proceedings,* v. 31, May '45, pp. 150-152.

Characteristics of brittle failures.

9-70. **Yielding and Fracture of Medium Carbon Steel Under Combined Stress.** E. A. Davis. *Welding Journal,* v. 24, May 25, pp. 283s-294s.

Results of combined stress tests on a medium carbon steel; attention to the magnitude and distribution of the stresses and strains at the instant preceding fracture. Effect of the shape of the test specimens and the isotropy of the material upon the rupture properties.

9-71. **Indentation Hardness.** G. C. Richer. *Metallurgia,* v. 31, April '45, pp. 296-299.

Outline of a physical interpretation based directly on stress-strain relationships.

9-72. **The Shape of a Material's Reactions to Force, Part 2.** A. C. Vivian. *Metallurgia,* v. 31, April '45, pp. 301-307.

Some type of coefficient for use in converting the standard (normal temperature and time) curve to the shape prevailing at other temperatures and loading rates should ultimately be devised, when the applicability of the new proposals will be quite universal to materials worth the name.

9-73. **Theory of Bending, Torsion and Buckling of Thin-Walled Members of Open Cross-Section.** Stephen P. Timoshenko. Franklin Institute *Journal,* v. 239, March '45, pp. 201-219.

Analysis of bending of thin-walled members of open cross-section and establishes the notion of shear center. By the use of Maxwell's reciprocal theorem there is established the identity of shear center and center of twist. Next come instability problems and torsional and lateral buckling of beams.

9-74. **Fracture Testing of Alloy Steels for Aircraft Engine Forgings.** R. D. Haworth, Jr. and A. F. Christian. American Society for Testing Materials, Preprint A4, 1945, 34 pp.

Unusual condition of alloy steel forgings, shown by fracture examination and termed "grain coarsening,"

has attracted considerable interest in recent years among the manufacturers of highly stressed aircraft engine parts. The appearance of large grains or "facets" on the fractured surface of fully heat treated forgings was generally considered indicative of overheating during the forging operation. However, it has been clearly demonstrated that this condition can be produced in certain heats of steel at normal forging temperatures. Other factors equally as influential as heat sensitivity are: (1) The time of temperature, and (2) the amount of reduction during the forging operation.

9-75. **Fatigue Tests of Airplane Generator Brackets with Special Reference to Failure of Screw Fastenings.** A. M. Wahl. *Journal of Applied Mechanics,* v. 12, June '45, pp. A-113-A-122.

Fatigue tests on forged steel airplane generator brackets of different proportions. In many cases the limiting factor in the strength of the assembly was not that of the bracket itself but rather that of the screw fastenings used to hold the bracket to the generator frame. The fatigue strength of these screw fastenings is largely dependent on the rigidity of the bracket rim.

9-76. **Effect of Length on Tensile Strength.** C. Gurney. *Nature,* v. 155, March 3, '45, pp. 273-274. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 155-A.

The results of a large number of tension tests on nominally identical test-pieces are conveniently represented by frequency curves. Equations and curves are developed for deriving the distribution of the strength of rods having lengths equal to a multiple of that of the rods tested.

9-77. **Changes Taking Place in the Crystal Structure of Metals Under Tensile and Alternating Stresses.** A. Thum and C. Petersen. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 547-551.

Attempt at untangling factors producing damage in fatigue by correlation with damping behavior at different loads and in different stages of fatigue. General speculation, rather than experimental evidence.

9-78. **The Influence of the Size and Form of the Cross Section on the Endurance Limit of Metal Under Asymmetrically Distributed Stresses.** L. Foppl. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 552-553.

Discussion of effect of stress gradient on endurance, based on experimental work of H. G. V. Phillips, published February, 1942, but not reproduced.

9-79. **A Small French Fatigue Testing Machine.** H. Oshatz. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 558-559.

Small testing machines for fatigue testing in tensile, torsion, or repeated bending are briefly described.

9-80. **Load Calibration Equipment for Testing Machines.** G. L. Brown and H. T. Loxton. *Journal* of the Institution of Engineers, Australia, v. 16, Dec. '44, pp. 235-239. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 155-A.

Methods used for the load calibration of all types of testing machines and their suitability and accuracy are discussed. A brief description is given of standard types of equipment, including a new design of loop dynamometer and the Amsler standardizing box.

9-81. **Methods of Testing Stopper Heads.** J. A. Shea. *Industrial Heating,* v. 12, June '45, p. 1016.

Laboratory tests for predetermination of the quality of stopper heads, that show good correlation with actual service results.

9-82. **The Yielding Phenomenon of Metals, V.** Georges Welter. *Metallurgia,* v. 32, May '45, pp. 31-36.

Influence of speed and loading conditions.

9-83. **A Convenient Form of Cast-on Indentation Hardness Test - Piece.** Thomas B. Crow. *Foundry Trade Journal,* v. 76, May 31, '45, pp. 96-97.

Sufficiently reliable data, as from cast to cast, will be obtained from a cast-on test-piece, particularly if it is run at the same place every time and other factors are kept as constant as possible.

9-84. **Fracture Characteristics of Magnesium Castings.** P. F. George. *Aluminum and Magnesium,* v. 1, June '45, pp. 14-17.

In detecting the type of fracture resulting from poor design or improper use it is important to determine whether the metal failed by tension, impact, torsion, shear, compression or fatigue. By the examination of the path of the fracture through the structure of the metal the type of stress can often be determined. 4 ref.

9-85. **The Effect of Overstress in Fatigue on the Endurance Life of Steel.** J. B. Kommers. American Society for Testing Materials, Preprint no. 23, 1945, 11 pp.

If the endurance life at one overstress is reduced by 50%, does that mean that the endurance life at a subsequent higher or lower overstress has also been reduced by 50%? In general, when a high overstress has produced a percentage of damage to endurance life, a subsequent lower overstress will show a greater percentage of damage. This damage to endurance life may be four times greater at the final stress than at the initial stress. When a low overstress is followed by a higher overstress, the damage to endurance life is less at the final stress than at the initial. Harder, stronger steels are more sensitive to damage of endurance life than the softer, weaker steels.

9-86. **Single-Strip Compression Test for Sheet Materials.** Harry LaTour and Don S. Wolford. American Society for Testing Materials, Preprint no. 30, 1945, 18 pp.

New jig for testing sheet materials in compression using a flat single-strip specimen. The jig prevents lateral buckling of the specimen by providing continuous support in the form of flat guides. Both ends of the specimen extend beyond the jig body an amount exceeding the total deformation during the test. Compression stress-strain data can be obtained on sheet materials using a routine procedure requiring about the same time and care as a comparable tension test. 12 ref.

9-87. **Non-Axial Loading of Gray Iron Tensile Specimens.** Jasper O. Draffin and W. Leighton Collins. *Foundry*, v. 73, July '45, pp. 94-95, 180, 182.

Results obtained with a limited number of tests made at various times with non-axial or eccentric loading.

9-88. **Modern Light Metals.** *Automobile Engineer*, v. 35, June '45, pp. 223-228.

Methods employed for routine testing are briefly described and reference is made to some of the more complex techniques for determining mechanical properties at elevated temperatures and to the X-ray back reflection method for measuring residual stresses.

9-89. **Fatigue Life of Parts as Affected by Grain Direction.** D. D. Stone. *Product Engineering*, v. 16, July '45, p. 442.

Improvement of fatigue life, in a sheet metal bracket assembly, was doubled through a change in grain flow direction. Describes the tests that were made which resulted in redesign for increased fatigue life.

9-90. **Testing Aircraft Structures.** E. H. Schwartz. *Aircraft Production*, v. 7, June '45, pp. 278-283.

Development and application of the adhesive-patch method.

9-91. **Tensile Deformation.** John H. Hollomon. *Metals Technology*, v. 12, June '45, T. P. 1879, 22 pp.

Effects of tensile strain and changes of metallurgical structure on the stress required for plastic flow are discussed. Over a wide range of strains, the stress required for plastic flow is found to vary with the strain to a small fractional power. For steels, this power relation extends from strains at least as small as 0.01 to strains of 0.4. 36 ref.

9-92. **Torsional Fatigue Testing Apparatus for Large Components.** E. Lehr and A. Skiba. *MTZ*, v. 5, nos. 6 and 7, July '43, pp. 175-182. *Engineers' Digest* (American Edition), v. 2, June '45, pp. 267-270.

To assess the actual service reliability, two factors must be ascertained: Magnitude, and variation with time (periodicity) of the forces, and moments to which the part is subjected during operation; and the fatigue strength of the part, that is, the range of the fluctuating forces and moments which the part is able to withstand through any number of cycles when applying, in the testing machine, stresses similar to those occurring in service.

9-93. **Hardness and Wear Resistance.** Martin Littmann. *Engineering*, v. 159, June 29, '45, pp. 502-503.

Attempt to determine to which other properties the wear resistance of individual metals corresponds; in all cases in which the wear resistance of a material is important, it would be advisable to rely upon the scratch hardness rather than on indentation or Scleroscope methods.

9-94. **Relative Mechanical Corrosion Hardness of Synthetic Corundum.** W. F. Eppler. *Industrial Diamond Review*, v. 5, June '45, pp. 121-125.

Investigation to determine numerical or quantitative hardness differences and effect of tempering. Evaluation of relative mechanical corrosion hardness by simply comparing the values.

9-95. **The Relation of Stress to Strain in Magnesium Base Alloys.** *Journal of the Aeronautical Sciences,* v. 12, July '45, pp. 273-280.

Stress-strain curves to the yield strength are given for most of the commercially available forms of magnesium base alloys. For the high-strength wrought alloys, typical curves based on tests of large numbers of different lots are presented. The curves for the other materials are the averages of a few tests on one lot. The values obtained for the modulus of elasticity were found to be a sensitive function of the testing technique. With careful testing the values were distributed quite closely around a mean of about 6,500,000 psi. This ratio of compressive yield strength to tensile yield strength is close to unity for the high strength wrought alloys and for the casting alloys. It is substantially less than unity for the lower strength wrought alloys. 11 ref.

9-96. **Correction of Aluminum Alloy Compressive Test Results for Material Properties Using Reduced Moduli.** Jacob Karol. *Journal of the Aeronautical Sciences,* v. 12, July '45, pp. 305-310, 328.

Presents a method of correcting compression test results of aluminum alloys for variations of test material properties from standard; method uses column curves based on reduced moduli. Correction curves are given for 24S-T Alclad sheet and 75S-T Alclad sheet. 10 ref.

9-97. **Curved Aluminum-Alloy Sheet in Compression for Monocoque Constructions.** Georges Welter. *Journal of the Aeronautical Sciences,* v. 12, July '45, pp. 357-369.

Throws some light on the mechanical behavior of thin light alloy sheets under compression and gives an explanation about minimum load that thin-walled structures can support under axial thrust. 7 ref.

9-98. **The Impact Strength of Some Metallic Arc Weld Metal Deposits at Elevated Temperature.** John F. Eckel and R. J. Raudebaugh. *Welding Journal,* v. 24, July '45, pp. 372s-377s.

Purpose is to determine the temperature range at which a loss of ductibility occurs in weld-deposited metal and to determine the cause of such loss of ductility. This knowledge should be of value in predicting auto-cracking tendencies.

9-99. **Fatigue Strength of Fillet, Plug and Slot Welds in Ordinary Bridge Steel.** *Welding Journal,* v. 24, July '45, pp. 379s-400s.

Fatigue testing, under axial loading, of several sets of steel specimens so designed that the tensile (or compressive) loads should be transmitted from one part to another through the shearing of fillet, plug or slot welds. The joints were in general such as might be conceived for connecting one end of a flat plate or

channel tension member in a bridge or building, to a gusset plate or a chord member.

9-100. **The Development of a Single-Blow Impact Test for Cast Iron.** Iron & Steel Institute, Advance Copy, June '45, 21 pp.

Simple test to evaluate measure of shock resistance. Recommended procedure evolved, now in regular use by a number of investigators prior to ultimate standardization. Peculiarities of the test on cast iron exist, such as the double-blow effect, whereby the broken part of the specimen shows frequently two or more impressions of the knife-edge. This phenomenon has been studied in detail and the mechanism of the double-blow effect finally established by a high speed photographic record of the test in progress. Other variables have also been studied with a view to their elimination as possible disturbing factors in the test.

9-101. **Notch Impact Tests.** C. F. Keel. *Welding,* v. 13, July '45, pp. 242-247, 252.

Survey of notch impact testing as applied to gas welds. Work carried out in both Switzerland and Germany in this field. (Report published in the Swiss *Zeitschrift fuer Schweisstechnik,* Nov., 1944.) 9 ref.

9-102. **The Theory of Indentation and Hardness Tests.** R. F. Bishop, R. Hill and N. F. Mott. *Proceedings of the Physical Society,* v. 57, May 1, '45, pp. 147-159.

Discussion of the indentation of ductile materials by cylindrical punches with conical heads. Experiments made with work-hardened and with annealed copper, with penetrations up to nine times the diameter of the punch. It is found that the load rises towards a maximum value which is not approached until the base of the cone has traveled four to five diameters into the copper block. 5 ref.

9-103. **The Determination of the Hardness of Martensite and Austenite by Means of the Microhardness Tester.** H. Hanemann. *Metallurgia,* v. 32, June '45, pp. 62-65.

Determines the hardness of martensite, austenite and their transition phases in a 1.7% carbon steel. Results of the investigation are given, together with a description of a new microhardness tester used for experiments. (From *Archiv für Eisenhüttenwesen,* v. 15, 1942, pp. 403-406.)

9-104. **The Yielding Phenomenon of Metals, VI.** Georges Welter. *Metallurgia,* v. 32, June '45, pp. 80-84.

Influence of speed and loading conditions.

9-105. **Research on Fatigue Strength of Screw Threads of Different Form.** D. G. Sopwith and T. Settle. *Engineering,* v. 160, July 20, '45, pp. 58-59.

Method of testing; materials; method of thread production; program of tests.

9-106. **Martempering Steel Limitations of Hardness Penetration.** B. F. Shepherd. *Product Engineering,* v. 16, Aug. '45, pp. 515-517.

Data on hardness penetration and analysis of the use of the Jominy test.

9-107. **Cast-to-Size Impact Specimens for Aluminum Sand Casting Alloys.** R. A. Quadt. American Society for Testing Materials *Bulletin,* no. 135, Aug. '45, pp. 24-26.

Results indicate that it is possible to produce quickly and cheaply cast-to-size Charpy impact specimens which satisfy the criteria outlined. Both notched and unnotched test specimens may be obtained from a single sand casting. It is thus possible to obtain data on two sometimes unrelated properties of an alloy—its impact resistance and its sensitivity to notching.

9-108. **Compression Testing of Magnesium Alloy Sheet.** A. A. Moore and J. C. McDonald. American Society for Testing Materials *Bulletin,* no. 135, Aug. '45, pp. 27-30.

Methods of compression testing of magnesium alloy sheet including a rapid means of obtaining an autographic stress-strain curve. This method, which should be satisfactory for other metals, combines an adaptation of the Baldwin-Southwark Model PSH-8 extensometer with a Montgomery-Templin type jig. Results of tests made by various methods, including "pack" and single-sheet, are given for magnesium alloys in thicknesses from 0.016 in. to 0.250 in. The use of a reduced-section specimen is recommended. 5 ref.

9-109. **Yield Stress and the Criteria of Yielding, Part V.** L. R. Underwood. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1360-1366.

Theories of strength; derivation of the Hencky-Mises condition of plasticity; constrained yield stress-derivation of the criterion $S_1 - S_3 = 1.15S_0$ commonly used in theories of rolling; condition of plasticity expressed in terms of normal stresses and a shear stress; criterion for plastic yielding when spread is not negligible; factors affecting the yield stress; distinction between hot and cold rolling; homologous temperatures; experimental determination of yield stress.

9-110. **Fatigue Strength of 5¼-In. Diameter Shafts as Related to Design of Large Parts.** O. J. Horger, T. V. Buckwalter and H. R. Neifert. *Journal of Applied Mechanics,* v. 12, Sept. '45, pp. A149-A155.

Reports the results of rotating cantilever bending fatigue tests made on shafts having different size fillets connecting a 5¼-in. diameter portion to a $6\frac{9}{16}$-in. section. Shafts were machined from normalized and tempered forgings of plain carbon steel of 0.52% C (S.A.E. 1050). Endurance limit for the $\frac{27}{32}$-in. polished fillet was found to be 25,500 psi., as compared with 18,500 psi. for the $\frac{9}{32}$-in. fillet. Rolling the $\frac{9}{32}$-in. radius increased this value to 24,000 psi. or an increase of 30% over the not-rolled fillet.

9-111. **Cumulative Damage in Fatigue.** Milton A. Miner. *Journal of Applied Mechanics,* v. 12, Sept. '45, pp. A159-A164.

Phenomenon of cumulative damage under repeated loads was assumed to be related to the net work absorbed by a specimen. The number of loading cycles applied expressed as a percentage of the number to failure at a given stress level would be the proportion of useful life expended. When the total damage, as defined by this concept, reached 100%, the fatigue specimen should fail. Experi-

mental verification of this concept for an aluminum alloy, using different types of specimens, various stress ratios, and various combinations of loading cycles, is presented. These data are also analyzed to provide information on different stress ratios when an S-N curve for any one ratio is known. Results of a sample analysis based on experiments are given. It is concluded that a simple and conservative analysis is possible using the concept of cumulative fatigue damage.

9-112. **Interchangeability.** C. A. Gladman. *Automobile Engineer,* v. 35, Aug. '45, pp. 329-334.

Basic principles underlying the application of tolerances.

9-113. **Notched-Bar Impact Test.** John H. Hollomon. *Iron and Steel,* v. 18, Aug. '45, pp. 387-394.

Significance and interpretation of results.

9-114. **The Effect of Hammer Blows on Welds Containing Cracks and/or Inclusions.** Elmer A. Ratzel. *Welding Journal,* v. 24, Sept. '45, pp. 455s-458s.

Results of a test designed to determine qualitatively the effect of hammer blows on a welded specimen having a known (deliberately made) initial defect indicate that the value of the hammer test of welded pressure vessels to uncover defects is questionable.

9-115. **Micro-Mechanical Testing of Metals.** N. Mironoff. *Welding,* v. 13, Sept. '45, pp. 352-354.

New type of apparatus for carrying out alternating bending tests on metals. Apparatus is suitable for testing welds, and results are given of tests conducted on a welded chromium-molybdenum steel specimen.

9-116. **Sources of Error in Diamond Pyramid Hardness Measurements on Hardened Steel.** W. N. Hindley. Iron & Steel Institute, Advance copy, Sept. '45, 10 pp.

Extent to which the results of diamond pyramid hardness (H_D) tests carried out by independent observers on hardened steel could be relied upon, experience having shown that some observers reported widely different results on material of the same nominal composition and heat treatment. Conclusions apply generally to all hardness testing. As materials or components are sometimes accepted only to a given H_D specification, it is important that the H_D figures obtained should be reliable. Wide variation in the results reported by independent observers was found, although results within close limits of agreement were obtained on the same samples by an experienced observer, when care was taken in the preparation of the flats. The wide variations obtained are attributed to carelessly prepared flats, and a standardized procedure for surface preparation is therefore recommended.

9-117. **Fridman's Theory of Strength of Materials.** G. Stanley Smith. *Metallurgia,* v. 32, Aug. '45, pp. 163-171.

Elastic deformation; transition from elastic to plastic deformation; plastic deformation; conditions of failure; failure from normal stresses (rupture); failure from tangential stresses (shear); unified theory of strength and the diagram of mechanical state.

9-118. Electrical Conductivity as Measure of Hardness in Cold-Aged Aluminum Alloys. *Automotive Industries,* v. 93, Sept. 15, '45, pp. 34-35, 76.

In non-destructive methods of testing materials by magnetic induction, electric conductivity is used to classify the material and its condition. Conductivity measurement shows differences between various alloys and between various states of a given alloy, provided the alloys or conditions compared differ in conductivity. If the change in conductivity resulting from thermal or mechanical treatment has been ascertained, it can be used to identify the treatment. Further, it can be employed for the indirect determination of any other regularly related property. Instance of the foregoing is the indirect determination of the hardness of cold-aged aluminum alloys.

9-119. Rolling of Metals: Theory and Experiment. V. Yield Stress and the Criteria of Yielding. L. R. Underwood. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1535-1545.

Determination of yield stress by means of tension tests; compression tests; factors affecting the yield stress in cold rolling; factors affecting the yield stress in hot rolling; summary of the factors affecting the yield stress in cold and hot rolling; distinction between yield stress and specific roll pressure. 46 ref.

9-120. Calculating Bend Allowances. J. B. Clegg. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1575-1577.

System based on practical investigations into the variable factors due to strain.

9-121. Temper Brittleness. John H. Hollomon. American Society for Metals Preprint 11, 1945, 69 pp.

During the tempering of most medium and high alloy steels a transformation can occur which decreases the impact energy of the steel without material effect on the other physical properties. Previous measurements on the effects of metallurgical variables upon the susceptibility to this embrittlement have been re-evaluated. Indicates decrease in impact energy is caused by a precipitate which forms from solid solution as do precipitates which cause age hardening. It is suggested that the precipitate may be iron nitride. Discussion of the relations between the effects of this precipitate on the impact properties and its effects on the flow and fracture characteristics of steel is included. 64 ref.

9-122. Effects of Combined Stresses and Low Temperatures on the Mechanical Properties of Some Non-Ferrous Metals. D. J. McAdam, G. W. Geil, and R. W. Mebs. American Society for Metals Preprint 18, 1945, 42 pp.

By means of tension tests of notched specimens an investigation has been made of the mechanical properties of K-monel metal, nickel, plain and leaded phosphor bronzes, commercial aluminum and high purity aluminum. Diagrams are presented to show the influence of notches and of the stress system on resistance to plastic deformation, resistance to fracture, and ductility between room temperature and −306° F. Study is made of the quantitative variation of mechanical properties with temperature. Discussion is also given of the correlation between ductility

and the stress-temperature lines for yield stress, ultimate stress and initial technical cohesion limit, and of the "normal" variation of mechanical properties with temperature.

9-123. **Fracture of Metals Under Combined Stresses.** D. J. McAdam. American Society for Metals Preprint 29, 1945, 29 pp.

Attention is confined to the influence of combined stresses. For a specific temperature, rate of deformation, and amount of prior plastic deformation, the resistance of a metal to fracture, its technical cohesive strength, may be represented by a curved surface in a diagram with the three principal stresses as co-ordinates. Cohesive strength of a brittle metal is represented by a surface symmetrical with reference to the locus of polar-symmetric stresses and either circular or hexagonal in cross-section. Surface tapers non-linearly to the point representing the disruptive stress. A similar surface may be used to represent the initial technical cohesive strength of a ductile metal. The ideal locus of fractures of a ductile metal has either circular or scalloped hexagonal cross-sections. If the surfaces have circular cross-section, resistance to fracture and resistance to flow are similar functions of the same variables, namely, plastic deformation, temperature, strain rate, and the stress combination. 17 ref.

9-124. **Quality Control, Part V—Mechanical Testing.** A. E. Hyde. *Canadian Metals and Metallurgical Industries,* v. 8, Oct. '45, pp. 26-29, 45.

Sampling; preparation of test specimens; mechanical testing equipment; tensile testing machine jaws; determination of yield strengths; determination of elongation.

9-125. **Microhardness Testing of Materials.** Vincent E. Lysaght. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1079-1084.

How the Knoop indenter has been commercially adapted in the Tukon hardness tester to provide an outstandingly useful tool for measuring the hardness of microscopically small areas of metals. 13 ref.

9-126. **Addition Method for Calculating Rockwell C Hardness of the Jominy Hardenability Test.** Walter Crafts and John L. Lamont. *Metals Technology,* v. 12, Oct. '45, T.P. 1928, 21 pp.

Outline of method; determination of addition increments; carbon-base hardness; alloy addition units; martensite increment; maximum hardness; discussion of the method of calculation; Jominy hardness of S.A.E. and NE steels.

9-127. **An Appraisal of the Factor Method for Calculating the Hardenability of Steel From Composition.** G. R. Brophy and A. J. Miller. *Metals Technology,* v. 12, Oct. '45, T.P. 1933, 10 pp.

Standard end-quenched hardenability bars were hardened in a General Motors quenching rig after having been heated 1 hr. at the temperatures shown. The hardness distribution was determined over their lengths at two flats 180° apart and the readings were averaged. Typical hard-

enability curves are shown. Results indicate that a further elaboration of the Grossmann principle will be necessary before it can be safely applied to steels of ordinary commercial complexity. 8 ref.

9-128. **Fatigue in Light Metals.** James L. Erickson. *Light Metal Age,* v. 3, Oct. '45, pp. 17-20, 31, 44.

Considers the phenomena of fatigue failure of metals, with special reference to aluminum and magnesium alloys. Discusses such aspects as the range of stress, method of performing fatigue tests, the effect of surface conditions, temperature, recrystallization, and elastic hysteresis. 20 ref.

9-129. **Plastic Bending—Approximate Solution.** Wm. R. Osgood. *Journal of the Aeronautical Sciences,* v. 12, Oct. '45, pp. 408-420.

Gives an approximate solution, which, in particular, makes it possible to determine slopes and deflections. The exact determination of these quantities is usually practically impossible in the plastic range. 3 ref.

9-130. **On the Dynamics of Elastic Buckling.** J. H. Meier. *Journal of the Aeronautical Sciences,* v. 12, Oct. '45, pp. 433-440.

Time-deflection relations are investigated when an axial force is rapidly applied to a nearly straight bar. Calculations show that a center deflection of 11% of the original hinge distance increases the elastic buckling force by only 1.5%, while the hinge distance is decreased by 3%. Where it is of importance and the damping constants can be established, a correction factor for damping can readily be applied to the respective equations. 3 ref.

9-131. **Influence of Prestressing and Cyclic Stressing on Stress-Strain Characteristics of Magnesium Alloys.** F. A. Rappleyea, R. E. Perry and G. Ansel. *Journal of the Aeronautical Sciences,* v. 12, Oct. '45, pp. 448-454, 460.

Factors that produce Bauschinger effects in most metals operate in magnesium. In addition, the stress-strain curves of magnesium upon prestressing or cyclic loading are influenced by the mechanisms of deformation (slip and twinning) occurring in this metal. Effects of recovery on the stress-strain curve are covered. Results are analyzed, and recommendations as to how to cope with the few problems caused by prestressing or cyclic loading are made. 13 ref.

9-132. **Photo-Grid Techniques for Measuring Distortion.** *Iron Age,* v. 156, Nov. 8, '45, pp. 78-81.

Stretch and flow of metal during forming operations or in the testing of tensile coupons can readily be observed by distortion of grids applied photographically to sheet metal or tensile specimens. Details of techniques recently developed by Consolidated Vultee Aircraft Corp. and North American Aviation, Inc.

9-133. **Progress Report on Fatigue Strength of Structural Welds.** American Railway Engineering Association *Bulletin,* v. 47, Sept.-Oct. '45, pp. 55-57.

Details of the specimens for the various tests are shown and results of the fatigue and static tests tabulated.

9-134. A Discussion on the Notch Impact Test and Its Interpretations. A. Fisher. *Metallurgia,* v. 32, Sept. '45, pp. 192-198.

The author discusses some of the obstacles which have prevented much progress towards rationalizing design methods for notched components; suggestions are made regarding testing methods and analyses of results.

9-135. The Effect of Combined Stresses on the Mechanical Properties of Steels Between Room Temperature and −188° C. D. J. McAdam, Jr., G. W. Geil, and R. W. Mebs. American Society for Testing Materials Preprint 22, 1945, 34 pp.

Tension tests were made of unnotched and variously notched specimens of carbon steels and alloy steels at several selected temperatures between room temperature and that of liquid air (−188° C.). Comparison is made with results obtained with some non-ferrous metals. Diagrams reveal the influence of combined stresses and stress concentration on mechanical properties at various temperatures. Other diagrams show the quantitative variation of these properties with temperature. Accelerated increase of the yield stress and decrease of ductility of iron and steels with decrease of temperature is anomalous. A "normal" metal shows not more than 75% increase of yield stress and no decrease of ductility with decrease from room temperature to −188° C. 12 ref.

9-136. A Sulphur Print Method for the Study of Crack Growth in the Corrosion-Fatigue of Metals. R. C. Brumfield. American Society for Testing Materials Preprint 28, 1945, 10 pp.

Description of the fatigue machine, the specimens and auxiliaries; damaging of the specimens; preparation of the specimens for sulphur printing; method for making sulphur prints; crack profiles; rate of crack penetration; method for analyzing sulphur prints; applications and limitations of the sulphur print method.

9-137. A Study of Size Effect and Notch Sensitivity in Fatigue Tests of Steel. H. F. Moore. American Society for Testing Materials Preprint 84, 1945, 15 pp.

Size effect in plain (unnotched) specimens is computed on assumption that a fatigue specimen which fails under cycles of reversed flexure behaves as if a fatigue crack started slightly *below* the surface of the specimen, where the nominal stress is slightly lower than that *at* the surface. Further assumption is made that at this point below the surface the nominal stress at failure is independent of size of specimen, and that the depth of this assumed starting point below the surface is also independent of the size of the specimen. The test results for six different steels gave endurance limits deviating from the results of computation based on the above assumptions ranging from 8.50 to 7.05% with a mean deviation of 4.19%. 5 ref.

9-138. Correlation of Stress Concentration With Fatigue Strength of Engine Components. Charles W. Gadd, Andrew Zmuda and N. A. Ochiltree. *SAE Journal,* v. 53, Nov. '45, pp. 640-647.

Tests on the actual machine component as manufactured in which it has been possible to make a direct check on the validity of laboratory stress measurements. Results give greater confidence in practical utility of laboratory test methods than would be justified from conventional material strength data.

9-139. **An Analysis of Wear of Aero Engine Parts.** W. N. Twelvetrees. *Aircraft Engineering,* v. 17, Oct. '45, pp. 301-305, 308.

Effects of four types of physical wear and three types of chemical wear in internal combustion engines.

9-140. **The Fatigue Strength of Aluminum and Magnesium Alloys.** H. F. Moore. *Aluminum & Magnesium,* v. 2, Nov. '45, pp. 14-17, 28-29.

Gives suggestions to designers and users of structural and machine parts made of light metal alloys, rather than tables and lists of properties which can be directly applied to design. 12 ref.

9-141. **Airplane Landing-Gear Fatigue Problems.** John Allan MacLean. *Aeronautical Engineering Review,* v. 4, Nov. '45, pp. 12-21.

Describes a number of service failures of landing-gear parts. Failures are believed to be due to low-cycle fatigue. Static. impact, and fatigue tests described, with a description of test apparatus and methods. 8 ref.

9-142. **An Examination of the Effect of Rate of Loading on the Ultimate Tensile Strength and Elongation of Magnesium Alloys.** J. L. Walker. *Metallurgia,* v. 32, Oct. '45, pp. 249-254.

Describes experiments and results of an examination of the rate of loading on tensile tests of magnesium alloys. Within the range examined A.8, as cast and solution treated; AZ.91, cast and fully heat treated; AM.503, as cast; and AZM, extruded, are insensitive or sensitive only to a negligible degree to variations in rate of loading while the Elektron alloys AM.503 and AM.537, in sheet form, are sensitive to a high degree. 6 ref.

9-143. **A Discussion on the Notch Impact Test and Its Interpretations.** A. Fisher. *Metallurgia,* v. 32, Oct. '45, pp. 281-284.

Discusses some obstacles which have prevented much progress towards rationalizing design methods for notched components; suggestions made regarding testing methods and analyses of results; and new formula given which is claimed to provide a rational interpretation and expression of "notch sensitivity." 39 ref.

9-144. **Work Hardened Surfaces of Fatigue Specimens.** Frederick C. Hull and H. R. Welton. *Metal Progress,* v. 48, Dec. '45, pp. 1287-1288.

Data on preparation of specimens, methods and results of tests, and recommended specifications for finishing of fatigue test specimens.

9-145. **Hardenability and Its Estimation.** *Metal Progress,* v. 48, Dec. '45, pp. 1289-1291.

Reviews papers presented at symposium held by Iron & Steel Div. of AIME. Seven dealt with factor method of

calculating the hardenability of steel from chemical composition.

9-146. **Raised Yield Strength in Bend Tests.** Given Brewer. *Metal Progress,* v. 48, Dec. '45, pp. 1306-1310.

Quantitative data on raised yield phenomenon in bending by subjecting deep-hardening, round bar of known physical properties to pure bending moment and recording stress-strain diagram for outside fibers. Wire type electric strain gages used. Test procedure outlined.

9-147. **Fatigue.** James L. Erickson. *Light Metal Age,* v. 3, Nov. '45, p. 39.

A bibliography.

9-148. **Strength of Welded Constructions.** J. Orr. *Welding,* v. 13, Nov. '45, pp. 462-470.

Experiments on the effect of residual stress.

9-149. **Graphical Method for the Evaluation of Principal Strains From Normal Strains.** Glenn Murphy. *Journal of Applied Mechanics,* v. 12, Dec. '45, pp. A209-A210.

Graphical methods are available for determining principal strains when observed strains are measured along gage lines, which make angles of 45 or 60° with each other. Presents simplified graphical method for general case in which angles between the gage lines may have any arbitrary values. 15 ref.

9-150. **Tension Tests at Constant True Strain Rates.** C. W. Macgregor and J. C. Fisher. *Journal of Applied Mechanics,* v. 12, Dec. '45, pp. A217-A227.

Tension tests of true stress-strain type reported for which true strain rate is maintained constant throughout each test. Several metals investigated under testing temperatures ranging from —183° C to 665° C. Influence of temperatures and strain velocity on true stress-strain properties described. Single variable called velocity-modified temperature is used to represent combined influences of true strain rate and testing temperature. 31 ref.

9-151. **Effect of Triaxiality on the Technical Cohesive Strength of Steels.** George Sachs and J. D. Lubahn. *Journal of Applied Mechanics,* v. 12, Dec. '45, pp. A241-A252.

Describes fundamental metal characteristics revealed by means of extensive notched tensile tests; effects of three major factors, triaxiality, plastic strain, and stress concentration, can be separated by means of systematic tests covering the dependence of notch strength characteristics upon numerous variables, such as notch radius, notch depth, and hardness (of heat treated steels). Characteristic strength values supplied by notched-bar tensile tests appear to be of considerably greater significance than those obtainable by means of regular tensile tests.

9-152. **How Cumulative Damage Affects Fatigue Life.** Milton A. Miner. *Machine Design,* v. 17, Dec. '45, pp. 111-115.

Deals with means for evaluating the cumulative effects of cycles of stress at various stress levels and method of relating various loading cycles (i.e., cycles of stress with different ratios of minimum to maximum stress). 4 ref.

9-153. **Fatigue Properties of Flash Welds.** H. J. Grover, R. W. Bennett and G. M. Foley. *Welding Journal,* v. 24, Nov. '45, pp. 599s-617s.

Investigation conducted for War Production Board at Battelle Memorial Institute. Program included three items of study: Investigation, by rotating-beam tests on small specimens, of fatique strengths and properties of various zones in the flash-welded bar; plate-bending fatigue tests on flash-welded plates designed to find the effect of weld reinforcement; rotating-beam tests on flash welded tubes scheduled to show importance of internal flash. All tests made on S.A.E. 4130 steel. Heat treatments described specifically.

9-154. **Notes on the Conditions of Fracture of Medium Steel Ship Plates.** D. F. Windenburg and W. P. Roop. *Welding Journal,* v. 24, Nov. '45, pp. 580s-587s.

Series of medium steel tensile specimens each 24 in. long, 12 in. wide and ¾ in. thick, with a notch at midlength and midwidth, tested to rupture under static loading at various controlled temperatures. Degree of ductility, as well as mode of rupture, was affected by temperature. Specimen notched with a hacksaw cut broke with a cleavage fracture at 75° F. whereas a similar specimen when tested at 100° F. broke with a shear rupture. Characteristics of the breaks were not altered by the presence of sharp fatigue cracks at ends of sawcuts. 4 ref.

SECTION X

ANALYSIS

10-1. The Volumetric Determination of Aluminum in Magnesium Alloys. C. H. Wood. Society of Chemical Industry *Transactions,* v. 63, Oct. '44, pp. 317-320.

An alkalimetric titration method has been developed for the determination of aluminum in magnesium alloys. The excess of free acid in a solution of the alloy is neutralized with sodium hydroxide solution using a screened indicator and the aluminum is then determined, using a second indicator, by titration of the equivalent amount of acid liberated by the addition of sodium citrate. The only interfering metal in normal "Elektron" alloys is manganese, but a simple correction can be applied.

10-2. The Statistical Control of Accuracy in Routine Analyses. H. G. MacColl. Society of Chemical Industry *Journal,* no. 49, Dec. 9, '44, pp. 418-421.

The principles of quality control which in recent years have proved so useful in controlling repetitive processes in factories can be applied with equal success to the control of accuracy in routine analytical determinations. The methods described are in use in the laboratories of The British Aluminum Co., Ltd.

10-3. Attack of Refractory Platiniferous Materials by Acid Mixtures at Elevated Temperatures. Edward Wichers, William G. Schlecht, and Charles L. Gordon. *Journal of Research,* v. 33, Nov. '44, pp. 363-381.

Iridium and other refractory metals and alloys of the platinum group can be easily prepared for analysis, or for small-scale refining, by solution with hydrochloric acid and suitable oxidants in sealed tubes at temperatures up to 300° C. The effects on the rate of solution of iridium caused by variations in temperature, in concentrations of hydrochloric acid and of the oxidant, and in the nature of the oxidant, are reported. The rate increases rapidly with increase in temperature and with increasing concentration of acid.

10-4. The Systematic Detection of Metals on the Small Scale. Christina C. Miller. *Metallurgia,* v. 31, Nov. '44, pp. 39-42.

Application of small scale methods to the systematic qualitative analysis of inorganic substances. Emphasis is laid on the employment of modern sensitive and

selective reagents, especially organic substances, for the identification of metals.

10-5. **Colorimetric Methods as Applied to the Analysis of Electroplating Baths.** D. Gardiner Foulke. *Monthly Review,* v. 32, Jan. '45, pp. 7-10.

Method for the determination of nickel which is rapid, accurate and neat plus quite inexpensive. 4 ref.

10-6. **Spectrographic Equipment for Foundry Metal Control.** H. W. Dietert and John A. Schuh. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 889-903.

Spectrographic analysis, through years of practical application, has developed into a necessary and profitable method of quick and accurate analysis of foundry metals, enabling analytical control of metal while it is being processed.

10-7. **A Combined Method of Chemical Analysis for Cast Iron, Malleable Iron and Steel.** Winfield B. Sobers. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 913-926.

Describes a combined chemical analysis routine for plain and alloyed cast iron, malleable iron and steel. Time saver for completing number of determinations, as well as in the handling and weighing operations of the sample. Less standard equipment and workroom space are needed for this type of analysis, which involves only a short training period.

10-8. **Hardness Test Separates Zinc From Cadmium Anodes.** A. A. Bradd. *Metal Progress,* v. 47, Feb. '45, p. 274.

Rapid and easy solution by hardness testing.

10-9. **Analysis of Aluminous Ore by Means of Spark Spectra.** J. Raynor Churchill and Raymond G. Russell. *Industrial & Engineering Chemistry* (Analytical Ed.), v. 17, Jan. '45, pp. 24-27.

A rapid economical spectrographic method for the analysis of aluminous ore has been developed which meets the requirements of a routine method for grade sorting and preliminary testing of ores. Similar techniques have been found useful on a wide variety of metallic and non-metallic powders. 2 ref.

10-10. **Rapid Volumetric Method for Aluminum.** L. J. Snyder. *Industrial & Engineering Chemistry* (Analytical Ed.), v. 17, Jan. '45, pp. 37-38.

A rapid and accurate procedure is described for the determination of aluminum in the presence of 1 to 10% of impurities such as calcium, copper, chromium, iron, magnesium, manganese, and zinc. Experimental data are presented showing the accuracy and the effects of impurities commonly associated with aluminum. Five to 10 minutes' time is required per analysis. 6 ref.

10-11. **Volumetric Determination of Calcium in Presence of Silica, Iron, Aluminum, Magnesium, Phosphorus, Titanium, and Manganese.** James J. Lingane. *Industrial & Engineering Chemistry,* (Analytical Ed.), v. 17, Jan. '45, pp. 39-41.

A volumetric oxalate-permanganate procedure is described which permits the direct determination of calcium in the presence of amounts of silica, iron, aluminum, magnesium, and phosphate, that are equal to or somewhat greater than the amount of calcium, and also in the presence of small amounts of titanium and manganese. The procedure employs only a single precipitation of calcium oxalate from acidic medium, duplicate determinations can be completed within two hours, and the accuracy compares very favorably with the more laborious classical methods which require the prior removal of most of the above elements. 4 ref.

10-12. **Analysis of Manganese Bronze.** Harold Ravner. *Industrial & Engineering Chemistry,* (Analytical Ed.), v. 17, Jan. '45, pp. 41-43.

A method is proposed whereby, with the use of a single sample weight, copper, lead, tin, iron, and nickel may be accurately determined in manganese bronze. Copper and lead are plated out in the presence of hydrofluoric acid which serves to hold tin in solution. Tin is subsequently separated from iron and nickel with hydrogen sulphide, reduced with lead, and titrated with potassium iodide-iodate solution. The hydrogen sulphide separation also serves to reduce iron to the ferrous condition, in which state it is determined by titration with ceric sulphate solution. Nickel is precipitated from the resultant solution with dimethylglyoxime. 6 ref.

10-13. **An Application of Spectrographic Methods to Chemical Concentrations of Trace Elements in Iron and Steel Analysis.** R. A. Wolfe and R. G. Fowler. *Journal of the Optical Society of America,* v. 35, Jan. '45, pp. 86-91.

Method is limited in speed and accuracy largely by the chemical techniques involved, but is more rapid than the chemical procedure, since it does not require individual separations of the elements. The accuracy reported is sufficiently good to be of use in many important research and control applications.

10-14. **Sulphur in Cast Iron.** Joshua T. Wilson and Josephine Bennett. *Foundry,* v. 73, Feb. '45, pp. 81, 218.

True evaluation of sulphur content in cast iron has been a problem for a number of years; simple direct procedure which is the composite of many now used.

10-15. **An Introduction to Metallurgical Spectrographic Analysis.** D. M. Smith. *Foundry Trade Journal,* v. 75, Jan. 18, '45, pp. 55-56.

Qualitative analysis; semi-quantitative analysis; accurate analysis with the microphotometer; effects of alloying constituents; preparation of electrodes; analytical accuracy; accuracy of spectrographic analysis. 3 ref.

10-16. **The Photometric Determination of Molybdenum in Metallurgical Products.** H. Cox and A. A. Pollitt. Society of Chemical Industry *Transactions,* v. 63, Dec. '44, pp. 375-378.

The conditions necessary for the production of a

stable molybdenum thiocyanate color within a practicable limit of time have been investigated and a procedure is described which insures that the color is developed quickly and remains stable. The procedure gives accurate and reproducible results.

10-17. **Colorimetric Methods for the Analysis of Magnesium-Base Alloys.** V. A. Stenger. *Metal Treatment,* v. 11, Winter '44-'45, pp. 229-234, 258.

Methods presented have been compiled from various sources and modified for the analysis of magnesium alloys with the aid of a photoelectric colorimeter (filter photometer) or spectrophotometer.

10-18. **Determining Traces of Bismuth in Copper by Means of Dithizone.** Yu-Lin Yao. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Feb. '45, pp. 114-115.

Method proposed for the determination of traces of bismuth in copper. No new principles are involved. Bismuth is first collected by hydrated manganese dioxide. Bismuth and lead are then extracted in an alkaline medium of cyanide by solution of dithizone in carbon tetrachloride. Finally bismuth is titrated by the solution of dithizone at pH 3. Since this method requires no special apparatus and takes only 2 to 3 hr. to run a single analysis, it is suitable for a control method in a copper refinery. 11 ref.

10-19. **Polarography.** G. W. Birdsall. *Steel,* v. 116, March 5, '45, pp. 122-123, 162, 164, 167-168, 170, 172.

Method of analyzing complex metal alloys is extremely fast, sensitive and carried out with simple equipment by easily learned and calibrated procedure. Extreme sensitivity detects as little as 0.0001% of an element with an accuracy of 1% of amount present. Tin plate industry and electroplating seen as most important immediate fields of application.

10-20. **The Rapid Evaluation of Aluminum Alloys by Spectrochemical Analysis.** Kenneth C. Peer. *Light Metal Age,* v. 3, Feb. '45, pp. 12-13, 23.

Rapid and reasonably accurate method of evaluating light alloy compositions.

10-21. **Determination of Thickness and Composition of Tin-Lead Alloy Coatings on Steel (Terne Plate).** J. W. Price. *The Analyst,* v. 70, Jan. '45, pp. 10-14.

Thickness of tin-lead alloy coatings on steel can be determined by weight loss on treatment with cold hydrochloric acid containing antimony trichloride. The amount of tin-iron alloy layer present in terne plate is generally so small that no correction is necessary for the iron dissolved by the stripping solution. The composition of the coatings can be found by determination of tin in the solution, after stripping, by titration with iodate under standardized conditions, using an empirical factor. Commercial terne plate coatings vary in thickness by as much as 100% over single sheets; coating compositions also vary, independently of thickness. 8 ref.

10-22. **Nitrogen in Steel.** *Iron and Steel,* v. 18, Feb. '45, p. 60.

Apparatus for estimation by the Kempf-Abresch method.

10-23. **Colorimetric Methods as Applied to the Analysis of Electroplating Baths, IV.** D. Gardiner Foulke and L. I. Horner. *Monthly Review,* v. 32, March '45, pp. 249-251.

Determination of iron. 4 ref.

10-24. **The Application of Spectrochemical Analysis in the Steel Mill.** P. R. Irish. Optical Society of America *Journal,* v. 35, March '45, pp. 226-233.

Operation at the alloy division of the Bethlehem, Pa. plant. (Paper presented at 29th Annual Meeting of Optical Society of America, Oct. '44.)

10-25. **The Chemist and the Microscope, I.** Cecil L. Wilson. *Metallurgia,* v. 31, Feb. '45, pp. 213-216.

The methods and requirements of chemical microscopy are briefly discussed and some indication is given of the many ways in which it can be used.

10-26. **Chemical Analysis by X-Ray Absorption.** H. A. Liebhafsky and E. H. Winslow. *General Electric Review,* v. 48, April '45, pp. 36-39.

Routine measurements quickly made on gases, liquids, and solids. Often useful in checking chemical composition of materials.

10-27. **Spectroscopic Analysis of Metals.** *Tool & Die Journal,* v. 11, April '45, p. 113.

Spectrographic technique is now standard for aluminum and magnesium alloys and many steels. Spectroscopy can accomplish an accurate analysis in many instances where chemical methods are not sufficient.

10-28. **The Gravimetric Estimation of Silicon in Aluminum Alloys.** G. H. Osborn and J. Clark. *Metallurgia,* v. 31, March '45, pp. 230-232.

Fuchshuber gravimetric method and causes of failure discussed; details of a suggested modification of this method given by which greater accuracy is obtained.

10-29. **Determination of Small Quantities of Nickel in Duralumin.** *Metallurgia,* v. 31, March '45, pp. 261-262.

Study of the factors affecting precipitation of the nickel complex in duralumin and, as a result of experimental work carried out, an improvement on existing methods of determining small quantities of nickel recommended.

10-30. **Desiccants in Microchemical Analysis.** Kenneth C. Barraclough. *Metallurgia,* v. 31, March '45, pp. 269-272.

It is frequently difficult to decide on an appropriate desiccant for any particular operation, and critical comparisons of the properties of the many available desiccants are difficult to find. Wide selection of desiccants discussed with reference to their specific applications.

10-31. Quantitative Spectrographic Determination of Minor Elements in Zinc Sulphide Ores. Lester W. Strock. *Metals Technology,* v. 12, April '45, T. P. 1866, 22 pp.

Development of quantitative d.c. carbon arc method; standard concentration curves; speed and extension of the method for determining the more abundant metallic constituents in ZnS. 4 ref.

10-32. Machining Spectrographic Samples. C. L. Waring. *Metals & Alloys,* v. 21, April '45, pp. 1013-1014.

Effect of surface preparation on the accuracy of spectrographic analyses demonstrated.

10-33. Chemical Control. F. F. Pollak and F. Pellowe. *Metal Industry,* v. 66, April 13, '45, pp. 231-233.

Routine method for the analysis of brass, with methods for aluminum, arsenic, manganese, antimony, phosphorus and zinc. 9 ref.

10-34. Modification of a Rapid Method for the Determination of Alkaline Earths and Other Metals. F. C. Guthrie and J. T. Nance. Society of Chemical Industry *Transactions,* v. 64, Feb. '45, pp. 50-51.

Determining alkaline-earth metals by direct titration with sodium carbonate, using phenolphthalein as indicator, made more accurate and rapid if a volume of acetone approximately equal to that of the neutral solution of the alkaline-earth chloride or nitrate is added before starting the titration. The addition of acetone lowers the solubility of the carbonates and prevents the pH of the solutions rising high enough to affect phenolphthalein until the precipitation of the alkaline-earth carbonates is complete. The method has been applied also to the determination of silver, lead and cadmium.

10-35. New Techniques in Analytical Chemistry. *Industrial Chemist,* v. 21, March '45, pp. 117-125.

Survey of recent advances. 45 ref.

10-36. Some Factors Affecting the Precision in Polarographic Analysis. Floyd Buckley and John Keenan Taylor. Electrochemical Society Preprint 87-17, April 16, '45, 16 pp.

The factors influencing the variables of the Ilkovic equation are analyzed. Tolerances in the control of the experimental conditions are estimated which permit chemical analyses or determinations of diffusion-current constants with a precision of $\pm$ 2%. The presence of maxima in polarographic waves and the effect of their suppression on the diffusion current are discussed. Criteria are given for determining when the current is represented by the Ilkovic equation.

10-37. Colorimetric Estimation of Aluminum in Aluminum Steel. C. Howard Craft and G. R. Makepeace. *Industrial & Engineering Chemistry,* (Analytical Edition), v. 17, April '45, pp. 206-210.

Colorimetric estimation of acid-soluble aluminum in steel by means of ammonium aurintricarboxylate in the range 0.04 to 1.5% aluminum. Experimental data given concerning the factors governing the formation,

stability, and reproducibility of the aluminum color. Interference of other elements commonly found in steel or likely to be introduced during the analysis discussed in detail. 15 ref.

10-38. **Rapid Photometric Determination of Silicon in Low Alloy and Stainless Steels.** David Rozental and Hallock C. Campbell. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, April '45, pp. 222-224.

Rapid silicon analysis is described which is ideally suited to the needs of the industrial laboratory. Routine accuracy of ± 0.02% silicon is achieved without use of blank solutions or buffers. Precalibrated correction graphs are constructed, which permit the use of distilled water as a reference solution. Method is adaptable to many types of colorimetry instruments for rapid routine analysis of alloy and stainless steels. 10 ref.

10-39. **Determination of Iron in the Presence of Cobalt.** Ernest A. Brown. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, April '45, pp. 228-230.

Colorimetric thiocyanate method is given for the estimation of 0.07 to 0.5 mg. of iron in the presence of variable amounts of cobalt up to 90 mg. Filter-type photometer with two color filters is used to circumvent the interference of the cobalt ion color. Method is rapid with an accuracy of ± 3%. 8 ref.

10-40. **Spectrophotometric Determination of Small Amounts of Copper Using Rubeanic Acid.** E. John Center and Robert M. MacIntosh. *Industrial & Engineering Chemistry,* (Analytical Edition), v. 17, April '45, pp. 239-240.

Spectral transmittance curves for copper, nickel, cobalt, and iron in a weak acetic acid solution with rubeanic acid are shown. Fading of the color and maximum permissible amounts of certain elements at 650 millimicrons are indicated. Transmittance vs. copper concentration curves have been prepared for wave lengths of 400 and 650 millimicrons. 10 ref.

10-41. **Determination of Copper in Copper Proteins.** Stanley R. Ames and Charles R. Dawson. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, April '45, pp. 249-253.

Specific method for the determination of copper in copper proteins involves use of the dropping mercury electrode after an acid extraction of the copper. The base solution for analysis is an acid sodium citrate buffer containing 0.005% fuchsin as a maximum suppressor. The copper can be quantitatively extracted and the presence of native protein and protein breakdown products has been shown to be permissible within prescribed limits. The method therefore eliminates the necessity of a tedious ashing procedure. The half-wave potential at 25.0° C. for cupric ion in the above base solution is —0.18 volt vs. the saturated calomel electrode. The diffusion coefficient at 25.0° C. of the cupric citrate complex in the above medium is equal to 0.43×10^{-5} sq. cm. per $sec.^{-1}$. Practical limits of the

method are from 1 to 75 to 100 micrograms per ml. of copper in the base solution with an average deviation of ± 3%. 34 ref.

10-42. Colorimetric Determination of Minute Amounts of Nickel. Emanuel Passamaneck. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, April '45, pp. 257-258.

Small amounts of nickel, especially in the presence of great excess of iron and other common metals, may be determined by precipitating the nickel dimethylglyoxime from an ammoniacal citrate solution of a small volume of the prepared material, dissolving the precipitate in pyridine, and comparing its color with a known solution of nickel dimethylglyoxime. 11 ref.

10-43. Continuous Photometric Determination of Bivalent Copper in Ammoniacal Solution. Earl H. Brown and James E. Cline. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, May '45, pp. 284-285.

Photometric instrument developed to record continuously the concentration of bivalent copper in the ammoniacal copper solution used at the TVA ammonia plant for absorbing oxides of carbon and other harmful impurities from the synthesis gas. The copper solution flows through the annular space between two concentric tubes in an all-glass light-absorption cell surrounding a light source operating on stabilized voltage. The light transmission is measured by a recording potentiometer in circuit with a barrier-layer photocell. 2 ref.

10-44. X-Rays Afford New Means of Chemical Analysis. *Iron Age*, v. 155, June 7, '45, p. 62.

Shooting a beam of X-rays through an unknown chemical substance to see how much of the radiation is absorbed is a new and rapid means of identifying the elements of which the material is made. Method can be used with gases, liquids or solids.

10-45. Qualitative Inorganic Microanalysis Without Hydrogen Sulphide, Part I. R. Belcher and F. Burton. *Metallurgia*, v. 31, April '45, pp. 317-319.

Detection of the common metallic ions on the micro scale. Sulphuretted hydrogen is not used as a reagent. Advantages and disadvantages discussed.

10-46. Determination of Sulphur in Steel. *Chemical Age*, v. 52, April 28, '45, pp. 367-368.

New apparatus for the rapid determination, by combustion, in about four minutes, of sulphur in iron, steel, and ferrous and non-ferrous alloys.

10-47. Detection of Beryllium in Copper-Base Alloys. Frank Kulcsar. *Chemist Analyst*, v. 34, May '45, pp. 28-29, 39.

Reagents; procedure; sensitivity; interfering elements. 2 ref.

10-48. How White Motor Company Checks Steel Analyses. D. B. Wilkin. *Steel*, v. 116, June 11, '45, pp. 120-122, 158, 160, 162.

Metallurgy department uses low power thermocouple system for checking incoming steel and material in inventory against master samples.

10-49. A Spot Test for Molybdenum in Steel. W. H. Hammond. *Iron Age,* v. 155, June 28, '45, pp. 75-76, 138-139.

Advantages of spot tests lie in their savings of time, money and material but such tests should be approached as a screening procedure and not as a substitute for quantitative chemical analyses. Simple test for determining the molybdenum content of alloy described herein was first developed in 1940 and has been in continuous use in several government stations since that time. Procedure is simple and requires no elaborate setups in equipment and chemical reagents. 28 ref.

10-50. Copper in Aluminum. *Metal Industry,* v. 66, June 8, '45, p. 359.

Method employs a mixture of perchloric acid and nitric acid to effect solution of the alloy.

10-51. Analytical Survey of a Rimming-Steel Ingot. J. S. Vatchagandhy and G. P. Contractor. Iron & Steel Institute, Advance copy, May '45, 8 pp.

A 5½-ton ingot of rimming steel containing 0.11% of carbon and 0.45% of manganese was sectioned along the vertical axis for analytical survey and sulphur-printing. The results of chemical analysis made with reference to the distribution of carbon, manganese, sulphur and phosphorus do not appear to indicate any significant departure from the known trend of variations of the segregating elements from the outside to the center of the ingot and from the bottom to the top. 15 ref.

10-52. The Determination of Nitrogen in Ferro-Alloys and Other Materials by Direct Nesslerisation Without Distillation. W. C. Newell. Iron & Steel Institute, Advance copy, May '45, 5 pp.

Direct method, without distillation, for the colorimetric determination of nitrogen applied to the analysis of ferro-alloys by the addition of stabilizing colloids to the Nessler-ammonia coloration. Its application to metallurgical analysis is shown to be extensive, resulting in a far simpler and speedier method for the determination of nitrogen in steel and other alloys. 9 ref.

10-53. A Micro-Spectrographic Method for the Quantitative Analysis of Steel Segregates. J. Convey and J. H. Oldfield. Iron & Steel Institute, Advance copy, May '45, 26 pp.

To obtain a quantitative analysis of the steels for carbon a higher steady-state potential of the spark gap was required. This was produced by blowing a small blast of dried air across the spark gap (pressure, ½ in. of water). The method was standardized and tested. Analyses of segregates were identical with those obtained with the spot-spark and traverse-spark techniques without air blast. Variations in the macro-

structures of segregates were found to agree with the content curves obtained via a traverse on the sample.

10-54. **Colorimetric Determination of Tungsten.** G. Stanley Smith. *Industrial Chemist,* v. 21, May '45, pp. 250-254.

Determining tungsten colorimetrically based upon the reaction of a tungstate solution, containing thiocyanate, with stannous chloride whereby a yellowish coloration is produced. 5 ref.

10-55. **"Lead Printing" Ferrous and Non-Ferrous Metals.** W. B. Wragge. *Metallurgia,* v. 32, May '45, pp. 3-6.

Introduction of small percentages of lead in steels to improve their machining properties has increased the need for developing a method of lead printing in order that the distribution of the lead can be examined. Technique described in this communication employs a dilute caustic soda solution which not only gives satisfactory prints of lead in lead bearing steels but is also applicable to non-ferrous metals.

10-56. **Qualitative Inorganic Microanalysis Without Hydrogen Sulphide, II.** R. Belcher and F. Burton. *Metallurgia,* v. 32, May '45, pp. 37-39.

Gives, in schematic form, details of the methods which were outlined in Part I.

10-57. **The Cobalticyanide Ion as a Precipitant for Metal Ions.** B. S. Evans and D. G. Higgs. *Analyst,* v. 70, May '45, pp. 158-165.

Determination of: (a) Cadmium in Pb-Sb-Cd and Pb-Sn-Cd alloys; (b) silver in lead; manganese in citrate solutions.

10-58. **Some Examples of the Use of the X-ray Powder Diffraction Method in Quantitative Analysis; the Determination of Small Amounts of (a) Calcium Oxide in Magnesium Oxide; (b) Zinc Oxide in Zinc Sulphide.** H. P. Rooksby. *Analyst,* v. 70, May '45, pp. 166-168.

Two examples of the use of X-ray powder diffraction methods in quantitative analysis are described. It is shown that calcium oxide can be detected in magnesia in as low a concentration as 0.1%. With zinc oxide in zinc sulphide the lower limit is approximately 0.2%.

10-59. **Spectrographic Analysis of Magnesium Alloys.** B. L. Averbach. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, June '45, pp. 341-348.

Describes the spectrography of a magnesium-base alloy containing 6% aluminum, 3% zinc, and 0.20% manganese. A statistical analysis of the procedure indicated that an accuracy of at least ±5% of the contained element was reasonable for this material. In addition, methods of casting a representative sample free from microshrinkage were investigated. 4 ref.

10-60. **Electrolytic Determination of Copper and Zinc in Brass Plating Baths and in Brass Electrodeposits.** A. S. Miceli and R. E. Mosher. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, June '45, pp. 377-378.

Electrolytic method for zinc and copper, in which the copper and zinc are codeposited from a cyanide solution containing ammonium sulphate and ethanolamine; the deposit is dissolved in sulphuric and nitric acids, and the copper is deposited; has been successfully used for the determination of copper and zinc in brass plating baths and in electrodeposited brass, and has also been adapted to the determination of cadmium, zinc, or copper in plating baths. 2 ref.

10-61. **Colorimetric Determination of Nickel with Dimethylglyoxime.** A. M. Mitchell and M. G. Mellon. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, June '45, pp. 380-382.

Spectrophotometric study was made of the colorimetric method involving formation of a soluble red complex by treating nickelic ion in ammoniacal solution with dimethylglyoxime. Metals which precipitate in ammoniacal solution are removed in the procedure, unless it is possible to prevent precipitation through some suitable reaction.

10-62. **Microdetermination of Copper with the Polarograph.** Christopher Carruthers. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, June '45, pp. 398-399.

Salicylaldoxime investigated as a reagent for the polarographic determination of small amounts of copper. 5 ref.

10-63. **Photometric Analysis.** D. F. Phillips and L. L. Edwards. *Metal Industry,* v. 66, June 29, '45, pp. 409-410.

Methods described which utilize the photometric measurement of solutions containing the brown complex of copper with sodium diethyldithiocarbamate and the red nickel-dimethylglyoxime complex. Ranges of 0.2 to 5% for copper and 0.2 to 3% for nickel are covered by a single calibration of the Spekker Absorptiometer for each element. 2 ref.

10-64. **Spectrophotometer—Analytical Tool Extraordinary.** Bryant W. Pocock. *Products Finishing,* v. 9, July '45, pp. 66-68, 70, 72, 74, 76.

Detailed instructions for the determination of chromium.

10-65. **Non-Destructive Spectrographic Sampling.** S. L. Widrig and F. W. Lutz. *Metal Progress,* v. 48, Aug. '45, pp. 276-279.

Major problem is to obtain satisfactory samples. Desirable qualities of sample are that it be in a form that provides satisfactory analytical accuracy, that excessive time is not consumed in its preparation, that the number of parts scrapped in obtaining samples is held to a minimum, and that they be handled conveniently in the laboratory.

10-66. **Recent Developments in Analytical Chemistry, XIV.** *Chemical Age,* v. 52, June 30, '45, pp. 560-564.

Neglect of analytical chemistry; two valuable re-

views; detection of bismuth; estimation of bismuth; detection of zinc; determination of zinc; volumetric methods; miscellaneous methods. 30 ref.

10-67. **Problems Concerning the Microchemical Balance, Part II—Cleaning.** David W. Wilson. *Metallurgia,* v. 32, June '45, pp. 85-88.

Microchemical balance is one of the most sensitive and delicate, and at the same time one of the most fundamental instruments employed in analysis. Fairly frequent cleaning is necessary, but it can easily be rendered useless, and indeed detrimental, by damage inadvertently caused during the process. The equipment and precautions necessary for the cleaning are described.

10-68. **The Routine Analysis of Aluminum Alloys by Colorimetric Methods.** D. F. Phillips. *Industrial Chemist,* v. 21, July '45, pp. 365-371.

Electrolytic methods; development of colorimetric technique; Spekker absorptiometer; advantages of colorimetric methods; colorimetric determination of copper and nickel; zinc by the polarograph. 2 ref.

10-69. **Determination of Nitrogen in Steel and Steel Welds.** R. H. Powell. *Welding,* v. 13, July '45, pp. 249-252.

Presence of combined nitrogen may confer upon steel properties which are either desirable or undesirable according to the use to which the steel is to be put. By the introduction of nitrogen into weld metal, that same hardness may produce brittleness, age hardening, low Izod values, and in general undesirable properties into the weld. Application of the Kjeldahl method of determination to steels led to design an apparatus whereby the nitrogen content of steel might be determined both rapidly and with reproducible accuracy.

10-70. **A Rapid Method for Determination of Silica in Iron Ore and a Spectrophotometric Method for Phosphorus.** Charles C. Hawes. *Metals Technology,* v. 12, Aug. '45, T.P. 1794, 10 pp.

Demonstrates that the methods described for determining silica and phosphorus are satisfactory and that the results obtained agree favorably with standard methods.

10-71. **Rapid Colorimetric Analysis.** *Steel,* v. 117, Aug. 27, '45, pp. 130, 156-157.

Improved analytical methods for determination of aluminum and silicon in iron and steel. Attains higher accuracy through improved methods. 2 ref.

10-72. **Application of Colorimetry to the Analysis of Corrosion Resistant Steels.** Lewis G. Bricker and Kenneth L. Proctor. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Aug. '45, pp. 511-512.

Procedure for the determination of small amounts of lead in corrosion resistant steels. Method is rapid and the precision is greater than in any other procedure investigated. Lead is removed from the bulk of interfering ele-

ments by utilizing a seeding out procedure, employing ammonium hydroxide and hydrogen sulphide, and is finally isolated by selective extraction with a chloroform solution of dithizone. Final estimation may be made both visually and by photoelectric colorimeter. 10 ref.

10-73. **A Method for the Determination of Alumina in Anodic Baths and Other Solutions Containing Hexavalent Chromium.** Winslow H. Hartford. *Aluminium & The Non-Ferrous Review,* v. 10, April-June '45, pp. 33-34.

Method developed for the routine determination of alumina in the presence of chromic acid and which is especially suitable for the analysis of anodic baths. When substantial quantities of alumina are present, an accuracy of 1% may be expected, but with small quantities of alumina, the method is somewhat less accurate. Moderate quantities of copper and trivalent chromium do not interfere, but iron is harmful. Method appears to be more accurate than other rapid methods for the determination of alumina, and does not require the use of any special equipment. 9 ref.

10-74. **Polarographic Determination of Lead in Brasses and Bronzes.** G. W. C. Milner. *Analyst,* v. 70, July '45, pp. 250-253.

Lead figures given in the tables represent the results by several workers and show the reproducibility of the polarographic determination. An agreement within $\pm 0.01\%$ with figures obtained by standard chemical methods was achieved for the brasses and bronzes containing a low percentage of lead, whilst agreement within $\pm 0.03\%$ was achieved for those with lead contents up to 4%. For bearing metals containing amounts of lead ranging from 20 to 28% agreement within $\pm 0.15\%$ can be attained provided that there is no doubt about the homogeneity of the original samples. By this method a single determination can be carried through in 20 min., showing considerable saving in time as compared with the chemical method with an equivalent accuracy. 5 ref.

10-75. **The Photometric Determination of Lead in Brass.** R. E. Oughtred. *Analyst,* v. 70, July '45, pp. 253-254.

Procedure has been devised whereby minute quantities of lead in brass may be accurately determined. It involves virtually complete precipitation of the tin as metastannic acid; precipitation of the lead as chromate from the filtrate, as in the method of Fisk and Pollak; solution of the lead chromate in nitrate acid and absorptiometric determination of the lead. 2 ref.

10-76. **Rapid Spot Test for Nickel in Steel.** E. R. Vance and H. S. Gonser. *Iron Age,* v. 156, Sept. 13, '45, p. 540.

Spot test method for nickel in which the intensity of the spot of red is proportional to the percentage of nickel present in the sample under test. Gives material required and procedure.

10-77. **Spectrographic Analysis of the Zinc Base Die Casting Alloys.** Robert Raisig. *Die Casting,* v. 3, Sept. '45, pp. 36-37, 39-40.

Presents the equipment and method used in the routine analysis of zinc base die casting alloys.

10-78. **Application of Micro Combustion Technique to Metallurgical Analysis.** G. Ingram. *Metallurgia,* v. 32, July '45, pp. 137-140.

Problems associated with the application of micro combustion technique to the determination of carbon in steels discussed. By elimination of the main sources of error it is possible to obtain results comparable with those obtained using standard procedures. The apparatus necessary is quite simple.

10-79. **A Ferrocyanide-Ceriometric Method for the Determination of Zinc in Ores.** J. P. Mehlig and J. K. Clauss. *Chemist Analyst,* v. 34, Aug. '45, pp. 52-54.

Method for zinc in ores, based upon the precipitation of potassium zinc ferrocyanide by an excess of standard potassium ferrocyanide solution and titration of the excess with standard ceric sulphate solution. 9 ref.

10-80. **Determination of Iron in High Silicon Aluminum-Base Alloys.** Louis Silverman, Anita Yunker and Anne Gearing. *Chemist Analyst,* v. 34, Aug. '45, pp. 57, 59, 62.

Copper powder reduction method. 2 ref.

10-81. **Colorimetric Determination of Molybdenum in Iron and Steel.** Mitchell Kapron and Paul L. Hehman. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Sept. '45, pp. 573-576.

Photometric method for determining molybdenum in ferrous metal employs water-soluble solvents of low volatility which produce a very stable molybdenum-thiocyanate complex color without the necessity for extraction. Interferences and their elimination, as well as the precision and accuracy of the method. 9 ref.

10-82. **Spectrographic Analysis of Iron and Steel.** H. F. Kincaid. *Western Metals,* v. 3, Sept. '45, pp. 11-15.

To analyze fabricated iron and steel a universal spectrographic technique is needed. This requirement is fulfilled with a commercial grating spectrograph and the use of the flat surface method of sampling. Technique used.

10-83. **Aluminum and Titanium.** J. Davis and L. J. Holton. *Metal Industry,* v. 67, Sept. 21, '45, pp. 178-180.

Details concerning the dissolution of the sample, preliminary separation of most of the heavy metals, conditions for electrolysis and the final estimation of aluminum and titanium. Concludes by naming the advantages claimed for these methods.

10-84. **Chromatographic Methods in Inorganic Micro-Analysis.** J. H. Beaucourt and D. L. Masters. *Metallurgia,* v. 32, Aug. '45, pp. 181-184.

Indicates briefly the development and principles of the technique; describes how it may be applied to inorganic problems. Since chromatography, regardless of its field of application, is necessarily restricted to the manipulation of small quantities of material, it may be regarded essentially as a micro method.

10-85. **Analysis of Nickel-Plating Baths.** *Canadian Metals and Metallurgical Industries,* v. 8, Oct. '45, p. 46.

Nickel; chloride; boric acid; ammonium; silicon bronze.

10-86. **Flame Photometry—A Rapid Analytical Procedure.** R. Bowling Barnes, David Richardson, John W. Berry, and Robert L. Hood. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 605-611.

New instrument has been developed to make possible the rapid quantitative determination of the alkali metals (primarily sodium and potassium) in aqueous solution. Principle of operation of the instrument is based upon the quantitative measurement of the characteristic light emitted when a solution of the metal is atomized as a mist into a gas flame. Details of construction and operation are given. 12 ref.

10-87. **Determination of Sulphur Dioxide—Improved Monier-Williams Method.** John B. Thompson and Elizabeth Toy. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 612-615.

Modification of the official A.O.A.C. Monier-Williams method is described which possesses a marked increase in sensitivity over the volumetric application of the official method. Comparisons are made with the official method and a modified Bennett-Donovan method using dehydrated vegetable products. 8 ref.

10-88. **Polarographic Analysis of Aluminum Alloys.** I. M. Kolthoff and George Matsuyama. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 615-620.

Procedures have been developed for the polarographic determination of iron, copper, lead, nickel, and zinc in aluminum alloys. The alloy is heated with sodium hydroxide and the solution completed in nitric acid. In the absence of chloride, ferric iron and copper give well-separated waves. If the ratio of iron to copper is large, the ferric iron is reduced with hydroxylamine hydrochloride. The lead wave is determined after reduction of the ferric iron and precipitation of copper as cuprous thiocyanate and adjustment of the pH. The nickel and zinc waves are determined after adjustment of the pH of the solution of the alloy, and addition of hydroxylamine hydrochloride, thiocyanate, sodium citrate, and pyridine. 2 ref.

10-89. **Electrogravimetric Determination of Copper in Copper-Base and Tin-Base Alloys, by Controlled Potential Electrolysis.** James J. Lingane. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 640-642.

Copper is deposited from a slightly acid tartrate solution, which, for the separation of copper from tin, possesses a number of advantages over the hydrochloric acid solution used in the well-known Schoch-Brown method. From an acidic tartrate solution cupric copper is reduced directly to the metal, whereas reduction from a hydrochloric acid solution is complicated by step-wise reduction through the cuprous state. 7 ref.

10-90. **Application of Colorimetry to the Analysis of Corrosion Resistant Steels: Determination of Zinc.** Lewis G. Bricker, Sidney Weinberg, and Kenneth L. Proctor. *Indus-*

trial & Engineering Chemistry (Analytical Edition), v. 17, Oct. '45, pp. 661-663.

Photometric method for the determination of zinc in corrosion resistant steels by the dithizone method is presented. A General Electric spectrophotometer with a slit width of 10 millimicrons was used in developing the method, but it has also been adapted to the use of a Klett-Summerson photoelectric colorimeter using a Klett No. 52 green filter. 16 ref.

10-91. **The Precipitation of Titanium by Tannin From Chloride Solution.** W. R. Schoeller and H. Holness. *Analyst,* v. 70, Sept. '45, pp. 319-323.

Titanium is quantitatively precipitated by tannin from chloride solutions containing free hydrochloric acid below 0.02N concentration; it can thus be separated from aluminum, iron and vanadium, but not from zirconium and thorium. Titanium and zirconium can be recovered together by tannin precipitation from chloride solutions containing aluminum, iron and vanadium under controlled acidity conditions. The separation procedure is described. 7 ref.

10-92. **Spectro-Chemical Analysis.** G. Stanley Smith. *Metal Industry,* v. 67, Oct. 12, '45, pp. 226-228.

Methods used in Russia for the spectro-chemical analysis of metals are the results of developments in technique evolved by the lack of elaborate instruments. Methods and way in which they are put into practice are described with special reference to two instruments in particular. 4 ref.

10-93. **An Application of Multiplier Photo-Tubes to the Spectrochemical Analysis of Magnesium Alloy.** George A. Nahstoll and Ford R. Bryan. Optical Society of America *Journal,* v. 35, Oct. '45, pp. 646-650.

Describes a method used successfully in one of the Ford Motor Co. spectrographic control laboratories.

10-94. **Photographic Materials for Quantitative Spectrography.** D. R. Barber. *Engineering,* v. 160, Sept. 28, '45, pp. 257-260.

Points out that photography is by no means a perfect photometric tool, and indicates some of the more important factors which need to be taken into account when choosing the most useful type of photographic material for the particular investigation in hand.

10-95. **The Application of the Vacuum-Fusion Method to the Determination of the Oxygen, Hydrogen and Nitrogen Contents of Non-Ferrous Metals, Alloys and Powders.** H. A. Sloman. *Metallurgia,* v. 32, Sept. '45, pp. 223-227.

This investigator has applied the method to several non-ferrous metals having easily reducible oxides, such as copper, lead, etc., but no satisfactory method has heretofore been devised for those metals such as aluminum, magnesium, etc., which have very stable oxides. (From Institute of Metals.)

10-96. **Application of Micro-Combustion Technique to Metallurgical Analysis, Part II.** G. Ingram. *Metallurgia,* v. 32, Sept. '45, pp. 237-239.

The determination of sulphur in steels by combustion technique is difficult to apply. The errors involved are discussed, and a solution to this problem is described, so that it is possible to determine the sulphur content in amounts above 0.01%, with 10-mg. samples.

10-97. **Photographic Materials for Quantitative Spectrography.** E. M. Amstein. *Engineering,* v. 160, Oct. 12, '45, pp. 297-300.

Effects of intrinsic properties of photographic process on spectrographic analysis. Indicates some of improvements achieved in properties of plates for spectrographic work.

10-98. **Fluorescence Test for Uranium.** Claude W. Sill and H. E. Peterson. *Chemical Age,* v. 53, Oct. 13, '45, pp. 336-339.

Method probably more specific and sensitive than usual qualitative methods for uranium, and its simplicity and speed of application make it ideal for testing samples. 4 ref.

10-99. **The Spectrographic Analysis of Austenitic Nickel-Chrome Steel.** S. D. Steele and J. M. Johnston. Society of Chemical Industry *Journal,* v. 64, Oct. '45, pp. 278-283.

Spectrographic determinations of silicon, manganese and aluminum contents of an 18-8 type chromium-nickel steel. Object of the work recorded was to determine whether the range of spectrographic determinations could be extended to justify inclusion of both chromium and nickel determinations in the spectrographic examination of the material.

10-100. **Some Applications of Vacuum Distillation Technique in the Analysis of Alloys.** J. W. Price. Society of Chemical Industry *Journal,* v. 64, Oct. '45, pp. 283-285.

Determination of alloy constituents by loss of weight on vacuum distillation has been successfully applied to zinc in tin-zinc alloys, lead in tin-lead solders, phosphorus in phosphor-tin, zinc in brass and gun-metals, lead in copper-lead and gun-metals, and cadmium in cadmium-copper. Effects due to presence of phosphorus in copper-base alloys and antimony in solder have been elucidated.

10-101. **Electrolytic Determination of Copper and Zinc in Brass Plating Baths and in Brass Electrodeposits.** A. S. Miceli and R. E. Mosher. *Metal Finishing,* v. 43, Nov. '45, pp. 458, 462.

Apparatus; solutions; procedure for analysis of brass plating solution; procedure for analysis of brass plate; interferences. 2 ref.

10-102. **Rapid Photometric Determination of Copper, Nickel, Manganese and Iron in Aluminum Alloys.** W. Stross. *Metallurgia,* v. 32, Oct. '45, pp. 257-261.

Well-known techniques for photometric determination of copper, nickel and manganese critically revised and partly modified. Existing scheme for determining many elements on one weighing discussed and a modification suggested.

10-103. **Methods of Micro-Filtration for Quantitative Analysis.** F. Burton. *Metallurgia,* v. 32, Oct. '45, pp. 285-288.

Selection of varied ways in which filtration may be carried out on a small scale.

10-104. Polarographic Determination of Nickel in Steel and Nickel Ore. Philip W. West and James F. Dean. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Nov. '45, pp. 686-688.

Rapid, accurate method for determining nickel in steel and nickel ore. Method is based on use of polarograph with sodium fluoride serving as supporting electrolyte. When nickel is present in quantities ranging between 1 and 5%, accuracies of approximately 1% can be expected. Method compares favorably with spectrographic techniques. 3 ref.

10-105. Simultaneous Spectrophotometric Determination of Titanium, Vanadium, and Molybdenum. Alfred Weissler. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Nov. '45, pp. 695-698.

Measurements have been made of the absorption spectra of the hydrogen peroxide complexes of titanium, vanadium, and molybdenum in perchloric acid solution. Inasmuch as the optical densities at various wave lengths are additive, it has been found possible to determine these three ions simultaneously in mixtures by using monochromatic light available in a spectrophotometer. Considerable saving of time is involved . 12 ref.

10-106. Rapid Method of Determining Minute Quantities of Carbon in Metals. J. K. Stanley and T. D. Yensen. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Nov. '45, pp. 699-702.

Rapid method for the determination of minute amounts of carbon (under 0.01%) described. Advantages are rapidity of analyses (about 20 min.), great sensitivity (1 mm. = 0.0001% carbon), and an accuracy of $\pm$ 0.0005%. Both milled and thin strip samples can be used; precautions necessary in their preparation discussed. Results for various samples of materials presented. 9 ref.

10-107. A Selective Spot Test for Copper. Philip W. West. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Nov. '45, pp. 740-741.

Test based on reaction between copper and dithiooxamide. By utilizing malonic acid and ethylenediamine to sequester interfering ions, all important interferences with this familiar reaction have been inhibited. Test is capable of detecting 0.3 microgram of copper at a limiting concentration of 1 to 100,000. No prior separations are necessary. 11 ref.

10-108. Spectrophotometric Determination of Nitrates in Plating Baths. Albert Dolance and Paul W. Healy. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Nov. '45, pp. 718-719.

Method for determination of nitrates in silver plating baths, using quartz spectrophotometer described, which for routine analysis is accurate to within 2.5 grams per liter. 4 ref.

10-109. Metallic Impurities in Steel. *Iron Age,* v. 156, Dec. 6, '45, p. 71.

Describes methods which have been tested, for analysis of metallic samples as well as solutions obtained by dissolving steel in nitric or hydrochloric acid, work chiefly being aimed at the determination of Mn, Cr, Ni, Mo, Co, V, Ti, Cu and Sn, as well as Al in the concentration range 0.1 to 0.001%. (Abstract from *Jernkontorets Annaler,* v. 129, no. 5, 1945.)

10-110. **Spectroscopy Applied to Ferrous and Non-Ferrous Materials.** Wm. J. Poehlman. *Welding Journal,* v. 24, Nov. '45, pp. 564s-572s.

By use of spectrograph, non-destructive analyses of metals, castings and forgings, bar and plate stock, weldrod wire and weld metal are procured accurately, with great economy and speed. Brief review of the origin and history given. Spectrograph and other equipment used in a modern laboratory, along with some typical results obtained illustrated. 9 ref.

10-111. **Micro-Spectrographic Method for Steel Segregates.** *Iron Age,* v. 156, Dec. 13, '45, p. 63.

Careful examination of segregate analysis revealed variations in element content within a single segregate. An attempt made to determine graduation in composition across a segregate by careful linear location of the actual points tested.

SECTION XI

LABORATORY APPARATUS, INSTRUMENTS

11-1. On the Silica Replica Method of Surface Examination with the Electron Microscope. R. F. Baker and F. H. Nicoll. *Journal of Applied Physics,* v. 15, Dec. '44, pp. 803-805.

Making a silica replica by the Heidenreich technique consists in the evaporation of silica in a high vacuum. An alternate method for depositing silica consists in the chemical deposition of silica from the compound $SiCl_4$.

11-2. Harnessing Time and Motion for Industrial Research. H. D. McLarty. *Iron & Steel Engineer,* v. 21, Dec. '44, pp. 70-73.

Ultra high speed photography has proven a valuable tool in many fields of industry, slowing rapid motions to a walk. This new medium is available for the investigation of individual problems.

11-3. Electrolytic Hydrogen Cells of Trail Design. B. P. Sutherland. *Canadian Chemistry & Process Industries,* v. 28, Dec. '44, pp. 812-814, 821.

Design details of a robust "streamlined" low cost cell suitable for continuous duty with minimum maintenance.

11-4. Comprehensive Exposure Chart for Micrography. Anton L. Schaeffler. *Metal Progress,* v. 47, Jan. '45, p. 96.

Chart covering the entire range of standard magnifications.

11-5. New Method of Mounting Metallographic Specimens. Ulric J. Hochschild. *Metals & Alloys,* v. 20, Dec. '44, pp. 1614-1615.

Metallographic microscope is the basic tool for quality control of metal-working processes involving changes in the structure of the material. More efficient metallographic inspection is the chief aim and outcome of the new method of mounting microspecimens.

11-6. A Contact Extensometer for the Determination of Operating Stresses. A. Thum and O. Svenson. *V.D.I. Zeitschrift,* v. 88, March 18, '44, pp. 153-154.

Extensometer described and its application explained.

11-7. X-Ray Diffraction. A. R. Weill. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 741-749.

Applications in the study of metals and alloys: Identification; quantitative analysis; stress measurement.

11-8. Problems Concerning the Microchemical Balance, Part I. Cecil L. Wilson. *Metallurgia,* v. 31, Dec. '44, pp. 101-102.

Precautions to be taken when installing a microchemical balance. The more important of these are considered, and it is shown that in the majority of cases serious expense or extensive structural alterations are not to be anticipated.

11-9. Beaded Glass Screen for Viewing Microstructures. J. D. Walker and J. J. Takaca. *Metal Progress,* v. 47, Feb. '45, pp. 272-273.

Utilizes an 18 by 18-in. beaded glass screen as an attachment on the metallograph. Permits public examinations of the specimen in question.

11-10. Identifying Specimen Mounts. William Koppa. *Metal Progress,* v. 47, Feb. '45, p. 274.

Inexpensive and everlasting method for identifying metallurgical specimens mounted in transparent plastics. Procedure.

11-11. Electrography Applied to the Examination of Electrodeposits. H. D. Hughes. *Journal of Electrodepositors' Technical Society* Reprint, v. 20, '45, pp. 17-30.

Electrographic method of examining metallic surfaces derived from the contact print methods of determining the location of sulphides in steel and of checking the porosity of electrodeposited coats on steel. Advantages of the electrographic method. Apparatus; procedure; methods of application to the examination of electrodeposits; identification of deposits; examination of deposits for quality; electrographic analysis. 10 ref.

11-12. Threaded Precision Gages Made to Exacting Specifications. *American Machinist,* v. 89, Jan. 4, '45, pp. 94-96.

Prewar experience aids Kobe in producing instruments for armed forces. Specialized measuring devices used to check accuracy.

11-13. The Sonigage. Wesley S. Erwin. *Aircraft Production,* v. 7, Feb. '45, pp. 63-64.

A supersonic contact instrument for thickness measurement.

11-14. Elements in the Design of Photoelectric Colorimeters. D. H. Matheson. *Chemist Analyst,* v. 34, Feb. '45, pp. 16-18, 20-24.

Review of most of the photoelectric circuits using the photo-voltaic type of cells which are applicable for use in colorimeters. The output of the photo-voltaic cells is not suitable for vacuum tube amplification and any advantage gained thereby is more than offset by the additional complications involved. 17 ref.

11-15. Electronic Applications Find Wide Use in Metal-Working. R. M. Serota. *American Machinist,* v. 89, March 1, '45, pp. 102-104.

While relatively new, industrial electronics has already filled practical shop needs. The field of use seems to be limited only by the ingenuity of the engineer. Cites advantages of high frequency induction heating.

11-16. **Metals by Electronics.** Vin Zeluff. *Scientific American,* v. 172, April '45, pp. 210-212.

In mines and mills, electronics speeds production, increases safety, improves quality. Some of the applications described point the way toward even greater diversification of the uses of electronics.

11-17. **Wire Wound Resistance Strain Gages.** *Wire Industry,* v. 12, March '45, p. 143.

Modern technique enables the aeronautical engineer to measure stresses in propeller blades arising from centrifugal and aerodynamic loads. Principle of strain gaging.

11-18. **Spline Gages Hold Close Tolerances.** B. P. Astley and A. S. McClenaghan. *American Machinist,* v. 89, March 29, '45, pp. 106-107.

Unable to procure involute spline gages immediately, a Westinghouse plant used equipment on hand to make its own gages.

11-19. **Comments on Dilatometer Operation.** H. W. Dietert. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1011-1019.

Specimen position in furnace; quartz tube for expansion test; thermocouple location; accuracy of hot strength readings; correlation of A.F.A. 2x2-in. with 1⅛x2-in. specimen readings; furnace preheat temperature; another operation method.

11-20. **The Acoustic Strain Gage.** R. S. Jerrett. *Journal of Scientific Instruments,* v. 22, Feb. '45, pp. 29-34.

Acoustic strain gage and its application to the measurement of surface strains produced both by static and dynamic loading. The apparatus consists of a test gage, a reference gage and a control set. The note from a vibrating wire in the test gage is matched against the note from a similar wire vibrating in the reference gage. The method of measurement is very sensitive and under normal conditions strains of the order of 1×10^{-6} can be recorded. The test gage may be used in remote positions and controlled from a distance. 4 ref.

11-21. **A 100-Kv Electron Microscope.** L. Marton. *Journal of Applied Physics,* v. 16, March '45, pp. 131-138.

Transmission type electron microscope with magnetic lenses. Electron speed can be varied between 30 ekv. and 100 ekv. The magnification of the instrument is produced in three stages. The instrument has improved air locks, hydraulically operated stage movement, and a stage tilting device up to $\pm 15\frac{1}{2}°$. It is also provided with means for bright and dark field illumination and for conversion into a diffraction camera. Improved electrical circuits provide the necessary stability of the power supplies.

11-22. **Strain-Gage Amplifier.** N. G. Branson. *General Electric Review*, v. 48, April '45, pp. 55-58.

How multichannel amplifier enables a magnetic oscillograph to be used with an electric gage to record dynamic and transient quantities.

11-23. **"Centerscope" and Optical Gaging System.** *Engineering*, v. 159, Feb. 23, '45, pp. 146-147.

New form of Centerscope illustrated showing it in use on a vertical milling machine mounted in a toolroom lathe. In both instances the operator views the work through an eyepiece, the work being illuminated during the operation by the small bulk and reflector shown.

11-24. **Caliper-Type Size-Indicating Gage.** *Engineering*, v. 159, Feb. 23, '45, p. 156.

Designed to indicate departures from the nominal size in fractions of an inch and thus should be useful in enabling the necessary tooling alterations to be made where a run of oversize or undersize parts shows this to be desirable, in addition to functioning in the normal way.

11-25. **Electronic Timing for X-Ray Exposures.** *Metallurgia*, v. 31, March '45, pp. 259-260.

Photo-electric X-ray timing device enables radiologists and technicians to obtain uniformly dense photofluorographic exposures with an overall increase in operating efficiency, claimed to be about 100%. The electronic timer times each exposure properly, quickly, and automatically.

11-26. **Something New in Remote Control.** T. J. Kauffeld. *Iron & Steel Engineer*, v. 22, April '45, pp. 61-64.

New system of remote control which has wide possibilities for industrial application.

11-27. **Electronics—Photoelectric Control.** Clark E. Jackson. *Modern Metals*, v. 1, May '45, pp. 21-24.

Describes the value of electronic control and where it can be used, together with the types of control which can be advantageously employed in the light metal industry.

11-28. **Electropolishing of Steel.** S. R. Prance. *Steel*, v. 116, April 23, '45, pp. 106, 109.

For microscopic examination.

11-29. **"Microptic" Vertical Measuring Machine.** E. R. *Engineering*, v. 159, March 30, '45, pp. 246-248.

No multiplying devices, the actual movement of the measuring contact being read directly by means of a microscope. Normal capacity covers measurements from zero to 4 in., the reading being made directly to within 0.00005 in. The accuracy of the instrument may be relied upon under any conditions to within 0.0001 in.

11-30. **Electronics of the Mass Spectrometer.** John A. Hipple, Don J. Grove and W. M. Hickam. *Electrical Engineering*, v. 64, April '45, pp. 141-145.

Value of the mass spectrometer as an instrument for the quantitative and qualitative measurement of the

components of gaseous mixtures is enhanced by a recording system which combines speed of response, accuracy, and extensive range. 7 ref.

11-31. **Continuous Determination of Carbon Dioxide by Electroconductivity.** Earl H. Brown and Maurice M. Felger. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, May '45, pp. 283-284.

Electroconductometric analyzer for the continuous determination of the carbon dioxide concentration in ammonia plant gases described. Results given by the analyzer to the operation of both the water and copper scrubbers of the gas purification system of the TVA synthetic ammonia plant given. The range of the analyzer described is 0 to 2%, but the analyzer is adaptable to other ranges. 3 ref.

11-32. **Comparison of Surface Roughness of Highly Finished Plane Surfaces.** J. Kluge and G. Bochmann. *VDI Zeitschrift*, v. 88, April 1, '44, pp. 179-181. *Engineers' Digest* (American Edition), v. 2, May '45, pp. 215-216.

Less important to determine surface profile than to ascertain whether repeated re-finishing of a surface will produce identical surface roughness. New apparatus developed for this. Instrument operates on the principle of throwing a parallel beam of light upon the surface under an angle of 45°. Reflected beam is then passed through a lens followed by an aperture and a photocell.

11-33. **Symposium on Surface Finish.** *Machinery* (London), v. 66, April 12, '45, pp. 403-405.

Measurement of surface waviness.

11-34. **Electronics at Work.** Clark E. Jackson. *Modern Metals*, v. 1, April '45, pp. 18-20.

Basic functions of electronics in light metal industry.

11-35. **Comparison Between Back-Reflection and Film-Impression Methods of Microscopic Surface Representation.** Edith Summler-Alter and Igeborg Ziesecke. *Zeitschrift für Metallkunde*, v. 36, May '44, pp. 115-119.

11-36. **The Amplidyne Generator from an Application Standpoint.** J. D. Campbell. *Iron & Steel Engineer*, v. 22, May '45, pp. 54-61.

Development of auxiliary exciters of special characteristics has resulted in improved control systems in a variety of applications. Under several trade names, units of this type have been widely used in steel plants.

11-37. **Evaluation of the Finish of a Metal Surface by a Replica Method.** Harry K. Herschman. National Bureau of Standards *Journal of Research*, v. 34, Jan. '45, pp. 25-31.

Method for evaluating surface finish through the medium of a nearly transparent plastic replica of a surface described. The method consists essentially in passing a narrow beam of light transversely through the moving replica onto a photoelectric cell. Variations in the geometric characteristics of the film, which are associated with the serrations of the surface reproduced,

control the intensity of the light passing through the film and reaching the photocell at any instant. The fluctuations of intensity of the transmitted light cause a pulsating voltage in the cell circuit, which is recorded by an electronic voltmeter. This voltage increases with increased surface roughness. The evaluations obtained by this means are very promising. Results for different surface finishes are correlated with profile measurements of the surface determined with the microscope. 7 ref.

11-38. **New X-ray Diffraction Apparatus.** *Chemical Age*, v. 52, April 28, '45, p. 369.

In the base of the cabinet is housed the high tension generator (including the tube filament transformer), from which full-wave rectified high tension is fed to the cathode of the X-ray tube, a circuit consisting of a center earthed transformer and two oil-immersed rectifying valves being employed.

11-39. **Surface Measurement.** *Aircraft Production*, v. 7, May '45, p. 219.

Instrument for recording the quality of finish operates on a simple pneumatic principle and gives a pen-record of the profile of the surface along a selected straight track. It is easily adjustable to suit any class of surface normally encountered in the modern engineering workshop.

11-40. **Electronics Provides New Tools for Chemical Industry.** *Chemical Industries*, v. 56, June '45, pp. 956-959.

The microwave spectroscope, electron microanalyzer, and the process of chemical synthesis by ion bombardment of solids.

11-41. **The Measurement of Surface Finish.** H. P. Jost. Liverpool Engineering Society *Transactions*, v. 65, 1944, pp. 49-70. Iron and Steel Institute *Bulletin*, no. 112, April '45, pp. 154-A-155-A.

11-42. **The Preparation of Cemented Carbides for Micro-Examination.** D. H. Shute. *Metal Treatment*, v. 12, Spring '45, pp. 13-18, 37.

Various methods of polishing cemented carbides for micro-examination. Etching also discussed and does not present any special difficulty provided certain fundamental differences in the compositions of the various grades are taken into account. Actual microscopic examination usually involves high magnifications. 9 ref.

11-43. **Electronic Control.** *Automobile Engineer*, v. 35, May '45, pp. 190-192.

Applications of B.T.H. equipment to resistance welding machines.

11-44. **Measurement of Stresses in Rotating Shafts.** W. F. Curtis. *Electronics*, v. 18, July '45, pp. 114-122.

Resistance-wire strain gages mounted on the shaft facilitate vibration analysis and fatigue-strength calculations. Methods of measuring both steady and alternating stresses caused by thrust, bending and torque

are discussed. Tests on the propeller shafts of naval vessels are used as examples.

11-45. **The Electric Strain Gage.** Given Brewer. *Metal Progress,* v. 48, July '45, pp. 91-96.

Elementary considerations of mechanics and the relationships between stresses, strains and directions will introduce a description of modern strain gages and their use. Their use is being extended by engineers of all sorts in a study of new designs, the determination of safe loads on existing equipment, or the investigation of obscure failures.

11-46. **Preparation of Specimens for Microscopic Examination.** Frank J. Cerman. *Better Enameling,* v. 16, June '45, pp. 6-10.

Basic methods for the preparation and subsequent examination of specimens.

11-47. **Instrument for Measuring Thickness of Non-Conducting Films Applied Over Non-Magnetic Metals.** Allen L. Alexander, Peter King, and J. E. Dinger. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, June '45, pp. 389-393.

Extensive application of camouflage paint to military aircraft, whose paint surfaces are constructed largely from the light metals and their alloys, emphasized the need for a non-destructive method for measuring thickness of paint films applied to non-magnetic metals; instrument described for making such measurements and data presented illustrating its use. The gage satisfactorily measures coatings containing metallic as well as non-metallic pigments. 3 ref.

11-48. **Survey Uncovers Potential Uses for Electronic Devices.** *Chemical & Metallurgical Engineering,* v. 52, June '45, pp. 110-111.

Survey defines the field of industrial electronics both in terms of actual devices in use and the problems of industry that electronic devices might help solve. Calls attention to some of these suggested applications.

11-49. **Metallographic Technique, I.** *Metal Industry,* v. 66, June 29, '45, pp. 411-412.

Polishing; mounting of wire and sheet; identification of specimens. 4 ref.

11-50. **New Developments in Electron Microscopy.** Robert G. Picard. Franklin Institute *Journal,* v. 239, June '45, pp. 421-436.

Developments which have importance in medicine, bacteriology, chemistry, physics and metallurgy.

11-51. **A Transfer Strain Gage for Large Strains.** Martin Greenspan and Leroy R. Sweetman. National Bureau of Standards *Journal of Research,* v. 34, June '45, pp. 595-597.

Simple strain gage, suitable for measurement of strains of from 16 to 32% on a 1.5-in. gage length, is described.

11-52. **Resistance Wire Strain Gage Applications and Circuits.** E. G. Van Leeuwen and W. F. Gunning. *Product Engineering,* v. 16, July '45, pp. 443-449.

Application techniques and problems of making and mounting resistance wire strain gages for stress-strain analysis discussed in detail. Describes strain gage circuits sensitive to stretch, bending, shear, torque, pressure and displacement.

11-53. **Electric Gaging Methods.** Howard C. Roberts. *Instruments,* v. 18, June '45, pp. 389-393, 410, 412, 414.

For strain, movement, pressure and vibration.

11-54. **Practical Electric Resistance Strain Gage Procedures for Structural Tests on Ships.** W. V. Bassett. American Society for Testing Materials *Bulletin,* no. 134, May '45, pp. 9-16.

Adoption of the electric resistance strain gage for studies of welding stresses in structures has required development of techniques for obtaining consistent results under outdoor and workshop conditions. Gage stability is necessary over longer periods than in other applications. Strain gage procedures described in this paper have given results accurate within ± 500 psi. Two fundamental test methods are: To observe changes in strains due to operations producing stress in the structure, and to measure relaxation of plugs trepanned or cut out from the structure after the operations are complete. Resistance strain gages applied to studies of welding stresses on subassemblies. 9 ref.

11-55. **Testing The Thickness of Non-Ferrous Castings.** B. M. Thornton. *Engineering,* v. 159, Feb. 2, '45, pp. 81-83. *Engineer's Digest* (American Edition), v. 2, June '45, pp. 293-295.

Principle employed in determining the wall thickness of intricate castings by electrical method is shown. Current from a direct-current source is passed through the metal wall by two contacts. The potential drop caused by the flow of current, which is indicated on a galvanometer and can be used as a measure of the wall thickness, is picked up by two closely adjacent contacts.

11-56. **A New Evaluation of Surface Finishes.** William F. Klemm. *Tool Engineer,* v. 14, June '45, pp. 42-44.

Width, not depth, of interruptions determines the wear resistance of surfaces. Standards used; means of comparing such finishes for control of surface quality.

11-57. **Metal-Working Discovers Electronics.** *American Machinist,* v. 89, July 19, '45, pp. 118-120.

Already widely used, electronic devices are regarded by industry as a potential solution to many plant problems. Survey reveals some interesting factual material on electronics.

11-58. **Surface Roughness.** L. P. Tarasov. *Industrial Diamond Review,* v. 5, July '45, p. 162.

Relationship of readings to actual surface profile.

11-59. **Metallographic Technique, II.** *Metal Industry,* v. 67, July 6, '45, pp. 9, 12.

Modern methods for producing an "ideal" specimen. 6 ref.

11-60. Note on Fusing of Instruments. B. F. McNamee. *Instruments,* v. 18, July '45, p. 455.

What is the effect on calibration?

11-61. Surface Measurement. *Aircraft Production,* v. 7, July '45, pp. 307-308.

Optical meter for fine reflective surfaces.

11-62. Interpreting and Recording Data From SR-4 Gages. Given Brewer. *Metal Progress,* v. 48, Aug. '45, pp. 270-273.

Describes some simple assemblages of electrical equipment necessary to measure and record the indications given by electric strain gages, the construction and theory of which was described in a preceding article. Type of such equipment varies within wide limits depending on speed of measurement, distance between object and instrument, on whether object is stationary or moving, and on whether individual measurements or autographic records are wanted.

11-63. Supersonics in Metal Finishing. *Monthly Review,* v. 32, July '45, pp. 688-690.

Production of supersonics; applications of supersonics.

11-64. Measuring Thickness. *Electronic Industries,* v. 4, Aug. '45, p. 101.

Gamma rays from radium source are used to measure wall sizes by detecting the reflections from molecules.

11-65. Electronic Measurement, Analysis, and Inspection—Part II. Holbrook L. Horton. *Machinery,* v. 51, Aug. '45, pp. 168-173.

Fundamentals of electronics and the ways in which electronic devices can be applied in the mechanical field.

11-66. Interpreting Surface Roughness Readings. L. P. Tarasov. *Machine Design,* v. 17, Aug. '45, pp. 137-138.

Shows how roughness measurements can be converted to linear microinches that can be visualized readily and handled in the same manner as any other linear dimension.

11-67. A Rapid Laboratory Method for Estimating the Basicity of Open-Hearth Slags. W. O. Philbrook, A. H. Jolly and T. R. Henry. *Metals Technology,* v. 12, Aug. '45, T.P. 1862, 11 pp.

Laboratory technique by which the basicity of basic open-hearth furnace slags could be estimated with sufficient accuracy. Process consisted of measuring the slight basicity of an extract of the powdered slag in water. 3 ref.

11-68. A New Coating Thickness Gage. S. Lipson. American Society for Testing Materials *Bulletin,* no. 135, Aug. '45, pp. 20-23.

New coating thickness gage described, which employs the electromagnetic principle for determining the thickness of non-magnetic coatings on steel. Principle of operation is given.

11-69. German Measuring Instruments Reflect High Degree of Precision. *American Machinist,* v. 89, Aug. 30, '45, pp. 99-102.

Collection of devices in the hands of the Navy Department shows close control of quality in enemy metal-working plants.

11-70. **Electronic Gage for Blind Operators.** *Steel,* v. 117, Sept. 3, '45, pp. 128, 180.

Permits precision checking the outside diameter of bearing races to within a twenty-five millionth of an inch.

11-71. **A Photoelectric Exposure Meter for Metallography.** A. J. Brunner. *Metals & Alloys,* v. 22, Aug. '45, pp. 416-417.

Construction and calibration of a useful device for rapidly estimating photographic exposures in metallographic testing and inspection.

11-72. **The Supersonic Reflectoscope for Interior Inspection.** Floyd A. Firestone. *Metal Progress,* v. 48, Sept. '45, pp. 505-512.

Instrument for the measurement or the non-destructive testing of solid parts for flaws by sending supersonic sound waves into the part and observing reflections from the boundaries of the part or from any flaws within it.

11-73. **The Supersonic Flaw Detector.** Eric N. Simons. *Metal Progress,* v. 48, Sept. '45, pp. 513-516.

By means of supersonic detection, metallic and other parts may be tested non-destructively. It employs the device of sending out a train of supersonic waves so short that the wave length is very much less than the distance between the boundaries of the medium being investigated. The transmitted and reflected wave-trains are shown on a cathode-ray tube (screen of an oscilloscope) in such a way that they do not interfere, and it is possible to detect an extremely small echo, even though it may be followed by other echoing reflections containing hundreds of thousands of times as much energy.

11-74. **Electronic Sound Gaging Device Developed by Timken.** *Modern Machine Shop,* v. 18, Sept. '45, pp. 180, 182, 184.

Makes possible employment of blind operators on inspection of parts.

11-75. **An Adjustable-Range Force-Measuring Spring.** *Iron Age,* v. 156, Sept. 20, '45, p. 63.

New type force-measuring beam provides comparable deflections under such widely divergent load ranges as 0 to 4000 lb., 0 to 20,000 lb., and the maximum, 0 to 100,000 lb. This new measuring beam has a stiffness which can be varied in accordance with the desired load range when applied to an automatic creep testing machine.

11-76. **A Simple Magnetic Tester for Determining the Thickness of Coatings on a Steel Base.** E. S. Spencer-Timms. Electrodepositors' Technical Society *Journal,* (Preprint), v. 20, '45, pp. 139-146.

Description of tester; method of use; calibration, reproducibility; summary of limitations of the instrument. 4 ref.

11-77. **Stresses and Strains Determined by Bonded Resistance-Wire Strain Gage.** *Steel,* v. 117, Sept. 24, '45, p. 143.

Bonded resistance-wire strain gage used in determining stresses in aircraft.

11-78. **Fundamentals of the Electronic Valve.** J. R. Cornelius. *Machinery* (London), v. 67, Sept. 6, '45, pp. 259-265.

Electronic tube or valve can be extremely useful to the mechanical engineer in many ways: For the safeguarding of machine tools, for human safety and against mechanical breakdown; the research into mechanical and electrical disturbances occurring in rapidly-moving machinery; unusual deflections in structures that appear perfectly rigid and solid; micro-measurement both of transient and static nature; and the use of high frequency cupolas and furnaces for the smelting and welding of difficult materials. Deals only with the electronic devices available to industry.

11-79. **A New Coating Thickness Gage.** S. Lipson. *Monthly Review*, v. 32, Sept. '45, pp. 888-892, 936.

Coating thickness measuring instrument for non-magnetic coatings on steel.

11-80. **The Thyratron and Cathode-Ray Tubes.** J. R. Cornelius. *Machinery* (London), v. 67, Sept. 13, '45, pp. 289-291.

Deals with two types of electron tubes of great use to the engineer.

11-81. **Electron Microscopic Investigation of Surface Structure.** Robert D. Heidenreich. *SAE Journal*, v. 53, Oct. '45, pp. 588-594.

Technique applicable to the study of the surfaces of rigid solids. Includes examples of structure of the bulk material as revealed by suitable etching techniques (metallography), and structure of the surface regions as they affect such factors as friction and wear, corrosion, adhesion of paints, and surface films.

11-82. **Dimensional Control to Millionths.** Richard Y. Moss. *Iron Age*, v. 156, Oct. 4, '45, pp. 79-81, 160.

Plunger and bushing manufacture for fuel injection equipment on the engines of B-29s late in the war was and is the most precise operation yet performed in mass production. Each grinding machine, equipped with flow-type air gaging equipment, turns out parts in quantity to a dimensional tolerance of 5 millionths of an inch.

11-83. **Photo-Grids.** Frank Hewlett. *Aircraft Production*, v. 7, Sept. '45, pp. 425-427.

Measuring flow and stretch in metal specimens and parts; sensitization of material.

11-84. **Electron Microscopy.** *Aircraft Production*, v. 7, Sept. '45, pp. 451-453.

Advances in laboratory equipment for the examination of metals.

11-85. **A New Coating Thickness Gage.** S. Lipson. *Metal Finishing*, v. 43, Oct. '45, pp. 412-414.

New coating thickness gage which employs the electromagnetic principle for determining the thickness of non-magnetic coatings on steel. Principle of operation is given.

11-86. **Some Production and Maintenance Instruments.** Clyde S. Cassels. *Iron & Steel Engineer*, v. 22, Sept. '45, pp. 97-100.

Instruments which have found considerable application in manufacturing plants: Profilometer; pneumatic com-

parator; gage for measuring moisture content of wood; the Strobotac, combination of stroboscope and tachometer.

11-87. **Gages for Quality Control.** R. M. Hays. *Western Machinery & Steel World,* v. 36, Sept. '45, p. 417.

Their use and care—cylindrical plug gages.

11-88. **Instruments for Measuring Dimensions.** *Metal Progress,* v. 48, Oct. '45, pp. 991-996.

A general review, by Orlan W. Boston. Rules, micrometers and calipers, by H. D. Hiatt. Comparators, by W. H. Baker.

11-89. **Instruments to Establish Identity.** *Metal Progress,* v. 48, Oct. '45, pp. 997-1003.

Magnetic comparators, by J. J. Smith. High frequency devices, by Patrick E. Cavanagh.

11-90. **Anti-Reflection Films for Metallographic Objectives.** James R. Benford. American Society for Metals Preprint 1, 1945, 19 pp.

Experimental studies on improvement in performance of metallographic microscopes due to anti-reflection films on the objective lens surfaces show the improvement to be dependent on the objective design and on the type of specimen viewed. Improvements accomplished by the filming consist of a gain in image contrast and a shortening of the photographic exposure. Photomicrographs are submitted showing comparative performance between filmed and unfilmed objectives. Results are supplemented by observations made with a visual comparator device which enables the observer to view two metallographic microscope images simultaneously. Photoelectric measurements of percentage flares in the images are correlated with the photographic and visual results.

11-91. **Adjustable Flush Pin Gage.** *Tool & Die Journal,* v. 11, Oct. '45, pp. 123-124.

Simple, fool-proof, yet adjustable gage capable of gaging depths to a maximum of 3 in. basic, and to tolerances of plus (or minus) 0.000 in. to 0.200 in. in steps of 0.001 in.

11-92. **Device for Automatic Protection of a Diffusion Vacuum Pump.** Theodore J. Wang. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, p. 670.

Simple arrangement described which serves to protect oil in the event of a leak. The scheme consists of utilizing the unbalance voltage developed in a Pirani gage to trigger a thyratron, which in turn opens the diffusion pump heater through a relay. Complete circuit for alternating current operation is shown.

11-93. **Lower Inspection Costs With Hard-Surfaced Thread Gages.** *Western Machinery and Steel World,* v. 36, Oct. '45, p. 481.

New process for constructing new gages or rehabilitating worn gages differs from all former methods. Life increases of from 5 to 60 times over ordinary tool steel are claimed, results being dependent upon material being gaged and operating conditions. Over a period of several years' use in war plants life increases have averaged approximately 20 times, according to the manufacturer.

11-94. Resolving Power of the Magnetic Electron Microscope. V. E. Cosslett. *Journal of Scientific Instruments,* v. 22, Sept. '45, pp. 170-174.

Factors limiting the performance of electron microscopes, spherical and chromatic aberration, diffraction, imperfections in lens construction. Methods of approach to the correction of aberrations. Even if the mechanical difficulties in lens construction are overcome, a very great reduction in spherical aberration is required to improve the resolution to below 10 A.

11-95. An Instrument for Recording Surface Waviness. *Machinery* (London), v. 67, Sept. 20, '45, p. 327.

Records waviness of a flat or curved surface, as instrument is moved over the face of the test-piece. Contact with the surface is made by a small steel ball set in a sliding spindle. The latter is attached to a recording arm giving a continuous record. A suitable ratio of magnification is 50 to 1, and the record may be magnified again by about 50 when under optical examination.

11-96. Industrial X-Ray Tubes. Z. J. Atlee. *Electronics,* v. 18, Nov. '45, pp. 136-140.

Survey of tubes used today in plants for microradiography with low-voltage beryllium-window types, X-ray diffraction with types having targets lower in atomic number than the material to be examined, and industrial radiography at 50,000 to 2,000,000 peak volts.

11-97. Special Testers for High-Precision Mechanisms. Lan J. Wong. *Instruments,* v. 18, Oct. '45, pp. 676-679, 712.

Extension spring tester, torsion spring tester, torque meter, strobotac calibrator and ball-bearing tester.

11-98. Electric Gaging Methods for Strain, Movement, Pressure and Vibration. Howard C. Roberts. *Instruments,* v. 18, Oct. '45, pp. 685-689, 706, 708.

Calibration-checking circuits; oscillographs.

11-99. Graphic Records Provide Production Analysis. W. J. Cotter. *Production Engineering & Management,* v. 16, Nov. '45, pp. 72-73.

Complete analysis of total production, productive operation time and machine down-time is possible with the record provided by this graphic instrument.

11-100. Microscopy With X-Rays. *Metal Industry,* v. 67, Oct. 12, '45, pp. 231-232.

Overcoming the limitations of the optical microscope. 2 ref.

11-101. Locating Initial Failure in Static Test Specimens. Richard W. Powell. *Automotive Industries,* v. 93, Oct. 15, '45, pp. 28-30.

Ideal instrument for this type of measurement should start to record at the instant of initial failure (or slightly before), should be reasonably portable, should be simple to operate and install, and should have no effect on the strength of the structure. The device described incorporates most of these features.

11-102. Apparatus in Qualitative Microanalysis, Part V. *Metallurgia,* v. 32, Sept. '45, pp. 239-240.

Extraction apparatus for qualitative microanalysis is described.

11-103. A Precision Micropipette to Deliver 0.5 or 1.0 Ml. G. H. Wyatt. *Metallurgia,* v. 32, Sept. '45, p. 240.

A simple, accurate micropipette is described.

11-104. Technique of Macrography, III. *Chemical Age,* v. 53, Nov. 3, '45, pp. 411-413.

Photographic apparatus and procedure.

11-105. The Recording of Strain by the "Parallel Resonance" Method. H. J. Beach. *Electronic Engineering,* v. 17, Oct. '45, p. 737.

Recording is effected by rectification in a Tetrode. Readings on oscillograms were 500 times actual movement of condenser gage.

11-106. Increased Resistance to Wear Achieved by Hard Facing. *Steel,* v. 117, Nov. 12, '45, p. 148.

Body of inspection cage made from forged ring 17¾ in. o.d., 13 in i.d. and 3 1/5 in. thick. Points of application of hard facing also shown. Result is an inspection tool which made it possible to check dimensions of small parts very rapidly.

11-107. Magnetic Tester. E. S. Spencer-Timms. *Metal Industry,* v. 67, Nov. 9, '45, pp. 298-300.

Necessity for a simple instrument which would enable thickness of deposits on a steel base to be determined resulted in production of tester described. (From Electrodepositors' Technical Society.)

11-108. Circular Slide Rule for Gamma Radiography. W. F. Cole. *Industrial Radiography,* v. 4, Fall '45, pp. 18-21.

Designed and constructed for calculating exposures for industrial gamma radiography using radon or radium.

11-109. Optical Comparator Made in the Shop. Ernest J. Heyman. *American Machinist,* v. 89, Nov. 22, '45, pp. 112-113.

Complete instructions given for making bench-mounted unit that costs little and takes the guesswork out of checking small items for several dimensions.

11-110. Continuous Gaging With X-Ray Micrometer. Robert C. Woods and Frederic Fua. *Iron Age,* v. 156, Nov. 29, '45, pp 50-51.

Thickness of sheet in motion can be gaged with high sensitivity by a device which combines X-rays and electronic elements. Can be applied to measure wall thickness of long metal tubing at any point, and in the case of coated metals, thickness of coating and that of the backing plate can be measured independently.

11-111. Thickness Measurement. S. Lipson. *Metal Industry,* v. 67, Nov. 2, '45, p. 280.

Coating thickness measuring instrument which was developed at Frankford Arsenal. (From ASTM *Bulletin.*)

11-112. 100-Million-Volt Electron Accelerator. *Electronic Industries,* v. 4, Dec. '45, pp. 90-93, 164, 166, 168.

Features of design and construction of apparatus for developing high electron velocities and super X-rays.

11-113. Adjustable Force-Measuring Beam. *Steel,* v. 117, Dec. 17, '45, pp. 102, 148.

Provides rapid, accurate stress deflections over wide range of loads.

11-114. Hypersonic Analyzer Betters Testing Technique. *Iron Age,* v. 156, Dec. 13, '45, p. 74.

Method whereby a sound generator sends beam through specimen. Specimen, depending on its properties, modifies beam and resulting energy pattern is picked up on side opposite generator by means of a microphone. It is possible to select a critical set of radiation frequencies and electro-acoustic designs so that the resultant beams through the material are highly modified by any given type of flaw in any given material.

SECTION XII

INSPECTION AND STANDARDIZATION

12-1. **A.I.D. Inspection in Aluminum Foundries.** E. Carrington. *Light Metals,* v. 7, Dec. '44, pp. 570-581.

Aims and practice of A.I.D. inspection for light alloy castings, and briefly outlines the established system for the development of official specifications.

12-2. **Symposium on Magnetic Particle Testing.** American Society for Testing Materials *Bulletin* no. 131, Dec. '44, pp. 7-16.

Equipment for Magnetic Particle Inspection, by A. V. deForest and C. E. Betz; Magnetic Particle Inspection, Particularly From the Standpoint of Specification Requirements, by H. H. Lester; Magnetic Particle Inspection of Aircraft Parts, by E. O. Dixon; The Magnetic Particle Test as Utilized by the Railroads, by L. B. Jones; Specifications and Procedures, by A. F. Spooner; Magnetic Powder Inspection of Castings, by Clyde L. Frear; Magnetic Particle Inspection of Forgings, by Clarence J. Boyle; Miscellaneous Applications of the Magnetic Particle Test, by E. A. Snader.

12-3. **Uniform X-Ray Exposures.** H. D. Moreland. *Steel,* v. 116, Jan. 8, '45, pp. 98, 100, 132.

Automatic photoelectric X-ray exposure control consists of two units—the photo-tube camera which measures amount of radiation that strikes the negative, and the assembly containing safety timer and power supply.

12-4. **Conferences on United States, Canadian and British Standards for Screw Threads.** *Machinery* (London), v. 65, Nov. 30, '44, pp. 611-614.

American delegates proposed the adoption of the truncated form of Whitworth thread. Desirability of devising a common standard for screw threads, both as regards the form of the thread and the commonly used series of diameters and their related pitches.

12-5. **Gage Control Assures Aircraft Pipe Thread Accuracy.** E. R. Hudson. *Tool Engineer,* v. 15, Jan. '45, pp. 73-76.

Carburetor manufacturer develops method to check points on gages where wear occurs most frequently. Simple, practical, and accurate method eliminates "human element" and is widely applicable.

12-6. **Simple Tool Inspection Method.** D. P. Walsh. *Tool Engineer,* v. 15, Jan. '45, pp. 89-91.

Application of commercial "black light" method to inspection of all types of cutting tools seems particularly helpful to carbide tool users and producers. Rapid analysis can aid in locating sources of trouble in tool manufacture and grinding.

12-7. **Precision Measurement of Balls for Instrument Bearings.** W. H. Meiklejohn. *Machinery,* v. 51, Jan. '45, pp. 147-151.

Measuring instruments of extreme accuracy must be used to insure readings in millionths of an inch.

12-8. **Checking Aircraft Assembling Jigs by Optical-Mechanical Means.** *Machinery,* v. 51, Jan. '45, pp. 171-176.

Checking of alignment and linear dimensions by means of optical equipment and micrometer trammels.

12-9. **Simple Gage for Checking Pump Gears.** B. T. Smith. *Machinery,* v. 51, Jan. '45, p. 177.

Gage for checking pump gears for thickness of tooth section, major diameter of gear, and concentricity.

12-10. **Metallurgical Control of Forging.** A. J. Pepin. *Steel,* v. 116, Jan. 15, '45, pp. 76-77, 88, 90, 92.

Important factors in controlling quality of aircraft forgings. Chemical analysis as guide in specifying should not be minimized.

12-11. **Casting Eight Inches Thick Examined in Three and One-Half Minutes by Two-Million Volt X-Ray Unit.** *Steel,* v. 116, Jan. 15, '45, pp. 95, 120.

78 times as fast as the million-volt machine. The new unit is mobile. Employs a multiple-electrode tube in which the electrons, starting from a heated filament at the top, are speeded in stages until they have the total rated energy.

12-12. **Better Battleships With X-Rays.** John L. Bach. *Welding Engineer,* v. 30, Jan. '45, pp. 38-39.

Speeding the day of our final reckoning with Tokio, X-ray inspection assures perfect welds and castings for our fighting ships and helps navy yards to send superb new naval units to sea in record-breaking time.

12-13. **New X-Ray Technique Introduced.** *Aero Digest,* v. 48, Jan. 1, '45, pp. 112, 229.

New technique is that of photographing on 35-mm. film objects projected on the fluorescent screen, a process known as photo-fluorography.

12-14. **Some Aspects of Casting Inspection as Seen by a Purchasing Agent.** R. V. Elms. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 750-757.

Outlines the procedure followed by author's company to obtain full agreement between themselves, as the buyer and the producer of the castings. Points out the responsibilities of the buyer as well as the vendor. Shows the need in the foundry for an inspection department with adequate facilities. Inspection departments, although non-productive, many times prove to be invaluable in detecting errors before too many scrap castings are produced.

12-15. **Standards in Times of Emergency.** Phil Carroll, Jr. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 945-959.

What is speed? Compromises are injurious; manpower; essentials of progress; training; effective time study methods; time study simplified; rate setting deficiencies; approach to data; data save time; standard setting; explaining standards; application of data methods; set-up standards; delay time; product vs. department measure; supervisory help; total effectiveness.

12-16. **Improved Sensitivity in Double Exposure Radiography.** James Rigbey. *Canadian Metals & Metallurgical Industries,* v. 8, Jan. '45, pp. 20-23.

Preliminary work; experimental procedure. 5 ref.

12-17. **Spotting the Focal Spot.** Alfred C. Wooll. *Metal Progress,* v. 47, Feb. '45, p. 271.

Spotlight attached to the tube of X-ray unit, adjusted so that, at the usual tube-to-film distance, the light falls directly below the focal spot of the tube.

12-18. **Strain Gauging for Machine Tools.** Paul I. Smith. *Machinery* (London), v. 66, Jan. 4, '45, p. 7.

Static strength versus dynamic strength; principle of the method.

12-19. **Some Cases for Steel as a Material.** E. P. Strothman. *Steel Processing,* v. 31, Jan. '45, pp. 39-42, 48.

A few practical experiences on the selection of steel for materials and processes. (Presented at the Annual Meeting, Society of Automotive Engineers, New York, Jan. 10.)

12-20. **Recent Progress in Testing, Inspection and Control.** *Metals and Alloys,* v. 21, Jan. '45, pp. 134-140.

Opening review of general trends in the broad field of tests, standards and specifications, followed by brief surveys of recent developments in each of the important testing and control methods and fields.

12-21. **Comparative Surface Roughness of Highly Polished Flat Surfaces.** J. Kluge and G. Bochmann. *VDI. Zeitschrift,* v. 88, no. 13-14, April 1, '44, pp. 179-181.

Special apparatus was developed to measure the reflectivity of polished surfaces.

12-22. **Efficient Acceptance (of Materials).** Karl Daeves. *VDI Zeitschrift,* v. 88, no. 15-16, April 15, '44, pp. 189-194.

The relation between actual stress and the ability to withstand stress represents only a presumptive value, determined generally by tests of short duration. For acceptance of a new material its uniformity and utility in service are more important than the absolute strength value established by short duration test.

12-23. **Non-Ferrous Tube Defects.** W. L. Govier. *Metal Industry,* v. 66, Jan. 5, '45, pp. 2-4.

Causes and prevention of flaws during manufacture.

12-24. **Optical Inspection.** George C. Brown. *Production Engineering & Management,* v. 15, Feb. '45, pp. 87-90.

Benefits of lower costs of machining precision parts can only be realized through similarly improved economy and efficiency in inspection. Where applicable, the optical method of inspection provides rapid and accurate checking, yet requires low skill of operator.

12-25. **A Method of Statistical Quality Control Inspection of Light Alloy Castings.** F. A. Allen. *Foundry Trade Journal,* v. 75, Jan. 4, '45, pp. 3-6.

Adaptation of the method of the inspection of machined components. 3 ref.

12-26. **Interpreting Aircraft Casting Radiographs.** *Foundry,* v. 73, Feb. '45, pp. 82-85, 192, 194, 196, 198.

System for identifying radiographic images with metallurgical defects and methods for assessing acceptability of defective parts. (Given at the American Society for Metals' National Metal Congress.)

12-27. **Electronic Tools in Chemical Research.** Robert H. Osborn and Lewis W. Beck. *Electronic Industries,* v. 4, Feb. '45, pp. 82-85, 142, 148.

Instruments for qualitative and quantitative analysis, inspection, and control open new vistas in chemistry.

12-28. **Non-Ferrous Tube Defects.** W. L. Govier. *Metal Industry,* v. 66, Jan. 12, '45, pp. 23-25.

Defects which occur in the production of copper shells by rotary piercing and in the extrusion of copper-rich alloys.

12-29. **Replica Method for Evaluating Finish of a Metal Surface.** Harry K. Herschman. *Mechanical Engineering,* v. 67, Feb. '45, pp. 119-122.

A new method for evaluating surface roughness described which involves the use of rapidly produced plastic replicas of variable transparency. Evaluations of surface finish made by this method on five specimens which differed significantly in degrees of finish were correlated with profile values of these surfaces determined by (a) the profilometer method (as root-mean-square values), and (b) the microscope on cross-sections (peak-to-valley values). These data show that this replica method is especially sensitive for the evaluation of surfaces having high degrees of finish. 7 ref.

12-30. **New and Resharpened Taps Receive Laboratory Inspection.** *American Machinist,* v. 89, Feb. 15, '45, pp. 112-113.

Standard test pieces are used in determining acceptance or rejection of taps. Complete inspection records are kept. Elimination of faulty taps reduces scrap.

12-31. **Non-Ferrous Tube Defects.** W. L. Govier. *Metal Industry,* v. 66, Jan. 19, '45, pp. 34-36.

In the process of cold reduction of tubes, defects are confined to tool troubles, while the cold-drawing process reveals previously hidden defects in addition to those produced from the fouling of the tools.

12-32. **Inspection by Radiography.** T. W. Fassett. *Aircraft Production,* v. 7, Feb. '45, pp. 57-62.

Interesting technique developed for the examination of Lancaster tubular welded engine mountings.

12-33. Non-Ferrous Tube Defects. W. L. Govier. *Metal Industry* v. 66, Jan. 26, '45, pp. 53-55.

Defects arising from annealing and pickling and the methods of detection of defects in finished tubes; stresses the importance of good planning and organization if a sound product is to be produced.

12-34. A Simplified Approach to Quality Control. George O. Cutter. *Iron Age,* v. 155, Feb. 15, '45, pp. 70-74.

Provides a simple working plan for both acceptance control and process control inspection for those people who have decided that quality control might be worth a try in their own plant or shop.

12-35. Laminations in Welded Steel Plates. Fred L. Goldsby. *Iron Age,* v. 155, Feb. 15, '45, pp. 66-69.

Chemical segregations, usually not serious, should not be confused with laminations, which are of two types, only one of which is dangerous. The author's analysis of the occurrence and detection of laminations should put fabricators' and purchasers' minds at ease to some extent. Experience at one of the largest elevated tank fabricators indicates that plate rejections due to laminations amount to about ¼% of all steel plate used.

12-36. Industrial X-Ray Exposures Timed Automatically. *Iron Age,* v. 155, Feb. 15, '45, p. 69.

Timer operates on the principle of the light exposure meter which amateur photographers use. X-ray radiation, passing through an object, strikes the fluorescent screen. A section of the luminous screen is scanned by a photoelectric tube which in effect measures the light leaving the screen. When enough light has left the screen for the desired film exposure, the photoelectric timer actuates a relay, opening the X-ray circuit and terminating the exposure.

12-37. X-Raying Developments. John L. Bach. *Modern Metals,* v. 1, Feb. '45, pp. 24-26.

Significant developments concerning X-raying which are speeding production and insuring quality throughout our war industries. X-ray inspection is particularly important in advancing foundry and fabrication procedures.

12-38. The Sigma Signal Indicator. *Machinery* (London), v. 66, Jan. 11, '45, pp. 45-48.

An electric visual gage comprising a unit or measuring head carrying three signal lights, a measuring spindle and two micrometer adjusting screws, designed primarily to facilitate the rapid inspection of components where it was only necessary to establish either plus or minus rejects and not necessary to measure the amount of error.

12-39. Microradiography: A Pictorial Abstract. Leslie W. Ball. *Light Metal Age,* v. 3, Feb. '45, pp. 18-20.

Based upon a slide-illustrated talk given before the American Foundrymen's Association.

12-40. **The Application of Radiography to the Improvement of Foundry Technique.** R. Jackson. Iron & Steel Institute Advance Copy, Jan. '45, 35 pp.

Principles involved in the taking and interpretation of a radiograph of a casting are given and the nature and extent of the defects which are revealed discussed. Examples given of the application of radiography to the examination of steel castings and of the methods adopted to improve the quality of castings. Tests carried out on steel castings improved by these means have shown their strength to be much greater than had been previously recognized. 6 ref.

12-41. **Adequate Contrast to Delineate the Common Defects in X-Raying Magnesium Parts.** Robert Taylor. *American Foundryman,* v. 7, March '45, pp. 17-19.

Visual inspection methods take on new importance in the production of sound castings. Most suitable densities for several thicknesses of metal. (Reprinted May 15, 1944, issue of *Aero Digest.)*

12-42. **Electronics in Railroading.** John Markus. *Scientific American,* v. 172, March '45, pp. 156-158.

Increased safety is the goal of many uses, direct and indirect, of electronics by the railways. Flaw detection in rails, materials testing, signal systems, and communications all involve the busy electron.

12-43. **Testing the Thickness of Non-Ferrous Castings.** B. M. Thornton. *Engineering,* v. 159, Feb. 2, '45, pp. 81-83.

Specification for making instrument.

12-44. **Latest Recommended Practice for Checking Commercial Forgings by Magnetic Particle Inspection.** *Steel,* v. 116, March 5, '45, pp. 126-128, 174, 176, 178, 180, 182, 184, 187.

Surface preparation; magnetizing equipment; powders; methods of magnetization; determinatin of current required; application of powders; interpretation of results; thermal cracks not visible; forging flow lines recognized; demagnetization.

12-45. **Vital Inspections of Aircraft Parts Made by Supersonic Measurement.** Wesley S. Erwin. *Steel,* v. 116, March 5, '45, pp. 131, 188, 190, 192.

Inaccessible surfaces no longer prevent absolute measurement of the thickness of metals. High frequency sound waves afford exceptional accuracy.

12-46. **Magnetic-Particle Testing Stations Reveal Surface Defects Rapidly.** F. W. Rohde. *American Machinist,* v. 89, March 15, '45, pp. 107-110.

Magnaflux units are located close to machining operations to detect invisible flaws in highly stressed engine parts. This prevents needless work on materials that are faulty.

12-47. **Standard Classification for High Speed Cutting Tools.** Anders Jansson. *Tool Engineer,* v. 14, Feb. '45, pp. 24-25.

As a definite step toward allaying much of the con-

fusion in classifying tool steels, three large consumers—General Motors, Ford, and Chrysler—have jointly standardized on classification symbols for high speed steel tools. The material is to be classified according to its major alloying element, its chemical composition in percentage, and the manufacturer.

12-48. **Quality Control.** B. P. Dudding and W. J. Jennett. *Metal Industry,* v. 66, March 9, '45, pp. 146-149.
Authors deal with the analysis of variance and of variability of measurement. 4 ref.

12-49. **Increased Output by Measuring and Testing During Production.** Walter Kaal. *Fertigungstechnik,* no. 6, Sept. '43, pp. 129-134. *Engineers' Digest* (American edition), v. 2, March '45, pp. 120-122.
Testing the quality of raw material and dimensions of finished work-pieces.

12-50. **X-ray Inspection With Phosphors and Photoelectric Tubes.** H. M. Smith. *General Electric Review,* v. 48, March '45, pp. 13-17.
How phosphors and photoelectric tubes can be used in X-ray detection of variations and their measurement. Application to automatic inspection of parts. X-ray absorption as thickness gage.

12-51. **Maintaining Scientific Tolerances by Inspection.** William B. Rice. *Mechanical Engineering,* v. 67, March '45, pp. 168-170.
Concepts involved; control-chart inspection; an assembly problem; statistical specifications. 7 ref.

12-52. **Quality Control.** B. P. Dudding and W. J. Jennett. *Metal Industry,* v. 66, March 2, '45, pp. 130-133.
Use of statistical methods in metallurgical industry. 1 ref.

12-53. **The Application of Statistical Methods to the Development and Quality Control of High Tensile Steel.** Charles M. Mottley. American Society of Naval Engineers *Journal,* v. 57, Feb. '45, pp. 21-55.
Brief history of the development of the steel; describes the organization of the unit which tackled the problems of quality control. A record is given of the chemical composition, physical properties and weldability of the manganese-titanium types of high tensile steel produced during the war emergency period after vanadium became critically short. The use of the latest developments in computing devices to solve the multiple regression problems, involving the effect of ten chemical elements on the physical properties and weldability described. The relation between yield point and tensile strength, the effect of the normalizing treatment on the physical properties, and the relation between Brinell hardness and the physical properties are discussed.

12-54. **Macro-Examination.** Donald Taylor. *Automobile Engineer,* v. 35, Feb. '45, pp. 43-50.
Investigation of defects in steel manufacture and usage.

12-55. **Supersonic Examination.** *Automobile Engineer,* v. 35, Feb. '45, pp. 76-77.

Instrument for measuring thickness by high-frequency sound waves.

12-56. **Inspection of Light-Alloy Forgings.** *Light Metals,* v. 8, Feb. '45, pp. 79-82.

Duties of inspectors in the stamp shop and associated departments, and the organization of an inspection system.

12-57. **Microradiography.** S. E. Maddigan. *Scientific American,* v. 172, April '45, pp. 219-221.

A powerful new tool and technique, the microradiographic application of X-rays in metallurgy, not to be confused with the familiar radiography to which it is an auxiliary, is giving aid in the improvement of existing alloys and the development of many new ones.

12-58. **Some Observations on the Structure of Acid-Resistant Vitreous Enamels for Chemical Plant.** G. E. Charlish and E. J. Heeley. *Foundry Trade Journal,* v. 75, Feb. 22, '45, pp. 147-152.

High-frequency spark test and the detection of voids in enamelled coatings.

12-59. **Where Magnetic-Particle Testing Stands as an Inspection Tool.** *American Machinist,* v. 89, March 29, '45, pp. 108-112.

Report on present stage of the art, compiled from data presented at symposium conducted in Philadelphia under auspices of A.S.T.M.

12-60. **A New Gaging Method for Quality Control.** P. M. Dickerson. *Tool & Die Journal,* v. 10, March '45, pp. 132, 134.

Patrol inspection plus control charts have reduced the rework from 10% to less than 1%.

12-61. **Making Rock Drills at Gardner-Denver.** *Steel,* v. 16, April 2, '45, pp. 114, 116, 118, 174, 176.

Complete inspection at many production stages assures perfect interchangeability of drill parts. Tolerances of 0.000025 in. held on many parts.

12-62. **Inspection of Industrial Materials Stressed by X-Ray Laboratories.** *Western Metals,* v. 3, March '45, pp. 37-38.

X-ray laboratories capable of radiographing all types of light and heavy metal castings.

12-63. **Magnetic Particle Inspection.** *Canadian Metals & Metallurgical Industries,* v. 8, March '45, pp. 27-30.

Progress in equipment, specifications and applications.

12-64. **Radiographic Specifications and Standards for Naval Materials.** Clyde L. Frear. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1078-1110.

Use of this method of inspection has resulted in a distinct improvement in the soundness of castings which enter into the construction of hulls and machinery. Specifications have been issued to cover the Navy requirements as to radiographic technique. To aid in

the interpretation of radiographs and decision as to the necessity for repair of defects, the Bureau of Ships has issued radiographic standards showing the acceptability of typical defects occurring in various classes of castings used in ship construction.

12-65. **X-Ray Micrography as a Tool for Foundry Control.** Leslie W. Ball. American Foundrymen's Association *Transactions*, v. 52, June '45, pp. 1111-1125.

Use of X-ray micrography and shows that with the proper equipment and technique the procedure can be simplified. Microcavities can be studied in sufficient detail to enable their proper diagnosis and correction. An identification library of radiographs together with corresponding micrographs can be provided to assist X-ray interpreters in making decisions regarding castings.

12-66. **Determining Soundness of Welds in Line Construction.** William E. Crenshaw and D. E. Abbey. *Petroleum Engineer*, v. 16, March '45, pp. 233-234, 236, 238.

Non-destructive precision method of preventive inspection used at stations as well as in laying of lines.

12-67. **Prevention of Flakes in Steel Forging Billets.** Paul S. Kingsley. *Metal Progress*, v. 47, April '45, pp. 699-704.

Studies made of the part played by internal stresses resulting from the phase changes taking place in the steel during cooling, the weakening effects of segregation, inclusions and dendritic pattern, and the internal pressure exerted by precipitated gases.

12-68. **A Proposed Matched Set of Steels.** J. E. Erb. *Metal Progress*, v. 47, April '45, pp. 724-728.

Simplification would result not only in enormous economies for American industry but also in improved quality of product. Sets forth a concrete, definite proposition.

12-69. **Can You Use a Simple Check for Diameters of 3-Fluted Tools.** Charles L. Hall. *Production Engineering and Management*, v. 15, April '45, p. 94.

With a standard 60° V-block and one measurement. Formula given for quick computation.

12-70. **Progressive Inspection Stations Assure Accuracy of Piston Rings.** D. M. Smith. *American Machinist*, v. 89, April 12, '45, pp. 114-117.

Close dimensional tolerances of aircraft rings require additional checking stations to those used in inspecting commercial rings.

12-71. **Electrography.** H. D. Hughes. *Metal Industry*, v. 66, March 16, '45, pp. 169-172.

Describes apparatus and methods for examining the surface of electrodeposits. (From Electrodepositors' Technical Society.) 8 ref.

12-72. **Some Methods of Establishing and Enforcing Controls of Surface Quality.** H. J. Forsyth. *Blast Furnace & Steel Plant*, v. 33, April '45, pp. 455-460.

Considers means by which some controls of surface

quality may be established and enforced in steel making operations to secure economies in salvaging costs and production rates. Experiences in a mill producing high quality killed steels described to illustrate factors which proved of value in development and control work.

12-73. **New Technique in Gage Control Raises Efficiency, Cuts Costs.** E. B. Sarreals. *American Machinist,* v. 89, April 26, '45, pp. 99-101.

Case history of an efficient gage control system proves that properly planned controls can improve production efficiency and raise inspection quality.

12-74. **Detection of Flaws by X-Ray Fluoroscopy.** H. Witte. *Zeitschrift des VDI,* v. 87, no. 33-34, Aug. 21, '43, pp. 529-534. *Engineers' Digest* (American Edition), v. 2, April '45, pp. 163-164.

Theoretical method to determine the smallest size of flaw, recognizable on the fluoroscopic screen.

12-75. **Measuring Piston Bores of High Speed Internal Combustion Engines.** A. Moser. *Werkstattstechnik, Der Betrieb,* vol. 37/22, no. 5, May '43, pp. 197-198. *Engineers' Digest* (American Edition), v. 2, April '45, p. 167.

Use of plug gages; testing tools or equipment; results according to area tolerance limits.

12-76. **Quality Control Involves Testing and Inspection for Obtaining and Maintaining Uniformity of Quality.** *Drop Forging Topics,* v. 10, Feb.-Mar. '45, pp. 1-5.

Definition of quality control; the design stage.

12-77. **Surface Finish and Its Measurement.** R. E. Reason. *J. Inst. Prod. Eng.,* v. 23, no. 10, Oct. '44, Edit. B, pp. 347-372. British Non-Ferrous Metals Research Association *Bulletin,* v. 25, April '45, p. 95.

Importance of physical and geometrical aspects with emphasis on the latter; basic stylus instrument; unit of measurement; graphs of surfaces; use of special instruments (auto-collimator, waviness instrument, roughness instrument with skid, Tomlinson instrument, profilometer, Talysurf) in connection with measurement of different kinds of surface imperfection.

12-78. **Symposium on Surface Finish.** *Engineering,* v. 159, March 23, '45, pp. 237-239.

Drawing office specification; rational specification of surface finish; requirements in surface finish; surface finish on production methods; results of modern practice.

12-79. **Diesel - Engine Bearings.** L. M. Tichvinsky. *Mechanical Engineering,* v. 67, May '45, pp. 297-308.

Discussion of failures and progressive inspection methods.

12-80. **Magnetic Crack Detection, II.** J. E. D. Bell. *Aircraft Engineering,* v. 17, March '45, pp. 88-90.

Describes the common defects which can be revealed by this system, and the machines and jigs used in their detection.

12-81. **Simple Diagrams Solve Problem of Thread Gage Instruction.** Montgomery Schuyler. *American Machinist,* v. 89, May 10, '45, p. 103.

Visual program gave inspectors a clearer mental picture of the relationship and operation of gages used in checking parts.

12-82. **Internal Inspection Device.** *Production Engineering & Management,* v. 15, May '45, p. 99.

Visual inspection of hole edges within small bores is performed on a production basis with microscope, two mirrors, and a light beam.

12-83. **The Use of Static Tests as a Method of Determining the Radiographic Classification of Castings.** Frank S. Wyle. *Industrial Radiography,* v. 3, Spring '45, pp. 13-20.

Defines some of the terms used by engineers in designing castings. Shows where the existing specifications require static testing and the sequence of stages between the original design and the final determination of classification. Examples of static tests which have been conducted and pitfalls which must be guarded against in making static tests. Other types of tests which are extremely valuable in setting radiographic standards.

12-84. **Foundry X-Ray Service.** Ned M. Field. *Industrial Radiography,* v. 3, Spring '45, pp. 23-25, 28.

What the foundryman expects from the X-ray laboratory.

12-85. **Safety Code for the Industrial Use of X-Rays.** *Industrial Radiography,* v. 3, Spring, '45, pp. 29-34.

Proposed code.

12-86. **Qualifications of an Industrial Radiographer.** Eugene Morze. *Industrial Radiography,* v. 3, Spring '45, pp. 34-35.

Type of examination, scope and method of application.

12-87. **X-Rays in the Light Alloy Foundry.** F. R. Mansfield. *Industrial Radiography,* v. 3, Spring, '45, pp. 36-43.

Practical application of routine radiography for development of sound casting methods and production control. Requisite plant and techniques detailed.

12-88. **Magneto-Inductive Testing.** W. Schirp. ***Metal*** *Industry,* v. 66, April 6, '45, pp. 216-217.

A magneto-inductive method of testing non-ferrous tubes and rods for defects, for correctness of heat treatment, for composition, for diameter and for wall thickness is described in this translation of an article from *Elektrotechnische Zeitschrift,* v. 64, 1943, p. 413.

12-89. **Steel Castings Radiography.** E. L. LaGrelius and C. W. Stephens. *American Foundryman,* v. 7, May '45, pp. 49-56.

Reviews briefly the underlying principles necessary for the production of good radiographs, proposes a concise radiographic terminology, and lists the probable causes for casting defects revealed by radiography.

12-90. **SAE War Engineering Board Report. Shop Procedure for Repairing Apparent Imperfections in New Automotive Gray Iron Castings.** *American Foundryman,* v. 7, May '45, pp. 68-71.

Representative of the American Foundrymen's Association and the American Welding Society appointed to review and recommend changes in OCO-D Engineering Bulletin No. 152, and to prepare a recommended shop procedure for repairing apparent imperfection in new automotive gray iron castings.

12-91. **Bolt Stress Measurement by Electrical Strain Gages.** G. A. Maney. *Fasteners,* v. 2, no. 1, pp. 10-13.

Results of an exploratory nature of research indicate the action of force and torque in wrenched-up bolts; describes a new technique for their measurement.

12-92. **Black Light Inspection of Aluminum Castings.** E. V. Blackmun and Edwin Bremer. *Foundry,* v. 73, May '45, pp. 96-99.

Fluorescent penetrant or black light method involves immersing the parts to be inspected in the penetrant for several minutes, removing the excess by draining, and washing, and then dusting the part with a light coat of talc. Latter withdraws and absorbs the fluorescent oil from the surface discontinuities and provides optimum conditions for examination of the part under near-ultraviolet or black light.

12-93. **Specifications for Steel Castings Now Being Revised.** *Steel,* v. 116, May 14, '45, p. 116.

Specifications for high strength steel castings for structural purposes and mild to medium strength carbon steel castings for general application.

12-94. **X-Ray Intensifying Screens.** John Delisa. *Steel,* v. 116, April 30, '45, pp. 110, 113.

Method for mounting lead foils.

12-95. **Relation of Surface-Roughness Readings to Actual Surface Profile.** L. P. Tarasov. American Society of Mechanical Engineers *Transactions,* v. 67, April '45, pp. 189-196.

Studies of surface finish have shown the desirability of relating profilometer roughness readings to actual peak-to-valley distances of the type that a micrometer measures. Approximate multiplying factors for converting profilometer readings into peak-to-valley roughness have been obtained from taper sections of a variety of abrasive-finished steel surfaces with profilometer roughness in the range of 1 to 100 microinches rms. For cylindrical ground surfaces, the factor can be taken as about 4½; for other types of fixed-abrasive finishes, as 6 or 7; and for loose-abrasive lapped surfaces, as 10. These are mean values, and individual factors may deviate by as much as one-third of the mean value. The factors quoted give values for "predominant peak" roughness; they should be doubled to obtain "deepest maximum" roughness, this being a second way of describing the peak-to-valley roughness.

12-96. **Testing and Inspection.** *Metals & Alloys,* v. 21, April '45, pp. 1112, 1114, 1116.

Testing methods and equipment for physical and mechanical properties, surface behavior and special characteristics. Radiographic, spectrographic, identification, metallographic, dimensional and surface inspection. Stress analysis and balancing. Specifications, standards and quality control.

12-97. **Inspection Tests for the Adhesion of Electroplated Coatings With Particular Reference to the B.N.F. Adhesion Test.** A. W. Hothersall and C. J. Leadbeater. *Metal Finishing,* v. 43, May '45, pp. 191-194.

Three types of tests investigated; each type embodied the same principle for indicating weak adhesion, viz., the deposit was made to expand, generally or locally according to the test employed, resulting in flaking or blistering at non-adherent areas. In general, the three methods differed only in the means of producing the expansion of the coatings.

12-98. **Salvaging and Process Control With the Cyclograph.** J. Albin. *Iron Age,* v. 155, May 17, '45, pp. 62-64.

Use of cathode ray device for non-destructive inspection of materials by use of automatic feeding machines to pass pieces into the Cyclograph coupled with mechanisms which separate the acceptable pieces from the rejects. Small malleable castings have been included in this form of automatic inspection.

12-99. **Magnetic Crack Detection, I.** J. E. D. Bell. *Aircraft Engineering,* v. 17, Feb. '45, pp. 58-60.

Principles and operational practice.

12-100. **Air-Operated Gages.** *Production and Engineering Bulletin,* v. 4, April '45, pp. 121-128, 132.

Application of pneumatic gaging extended by using higher operating pressures.

12-101. **Safety Inspection of Finishing Departments.** J. A. Bede. *Organic Finishing,* v. 6, May '45, pp. 31-33.

"Safety Inspection Check List" is given.

12-102. **Weldment Inspection Methods.** *Industry & Welding,* v. 18, June '45, pp. 38-39, 43, 102-104.

Radiography; magnetic tests; equipment; stethoscope test; microscopic examination.

12-103. **Dynamic Inspection Method of Checking Bearing Tolerances.** Richard McKendry. *Product Engineering,* v. 16, June '45, pp. 372-373.

Principles underlying the dynamic tolerance method of testing bearings for initial friction, end play or wobble, and coordinate speed. Method is a radical departure from established inspection methods based on the direct system of measuring radial, axial, and torque tolerances. Testing machine, auxiliary apparatus, and procedure described.

12-104. **Electronic Measurement, Analysis, and Inspection. I.** Holbrook L. Horton. *Machinery,* v. 51, June '45, pp. 157-161.

Ways in which electronic devices can be applied in the mechanical field.

12-105. **Magnetic Powder Inspection of Castings.** Clyde L. Frear. *Foundry,* v. 73, June '45, pp. 104-107, 273, 274, 276, 278.

Magnetic powder use for disclosing defects in steel castings.

12-106. **Magnesium Alloy Aircraft Casting Inspection.** Robert Taylor. *Iron Age,* v. 155, June 7, '45, pp. 63, 142.

Gas bubbles entrapped below the surface of the casting are often protected by a tough oxide skin from the effect of the sand blast. Method of distinguishing color patches following a chrome pickle treatment which leads to the detection of such cavities.

12-107. **Air Gages for Inspection of Precision Work.** A. R. *Machinery* (London), v. 66, April 19, '45, pp. 425-426.

Precision inspection of parts, and their classification in groups of uniform size within accuracy limits of 0.0001 in. simplified by the use of air gages of identical design.

12-108. **A Photo-Induction Defectoscope.** *Metallurgia,* v. 31, April '45, pp. 293-295.

Detecting defects in metals by means of photoelectric measurements. Novel and relatively simple testing method which appears worthy of further study.

12-109. **The Yielding Phenomenon of Metals, Part IV.** Georges Welter. *Metallurgia,* v. 31, April '45, pp. 309-315.

Influence of speed and loading conditions.

12-110. **Routine Inspection by Optical Projection.** *Machinery* (London), v. 66, April 26, '45, pp. 445-449.

Hilger projector is readily adaptable to routine inspection of comparatively small components which are produced in large quantities.

12-111. **A New Gaging Method for Quality Control.** P. M. Dickerson. *Steel,* v. 116, May 28, '45, pp. 105, 146.

Method for detecting trends and distributions in defective production, used in conjunction with go-no-go gages, charts parts progress in relation to tolerances on hourly basis. Rework reduced from 10 to less than 1%.

12-112. **Determination by Statistical Analysis of Process Minimums for Spot Welding.** Harold Robinson. *Welding Journal,* v. 24, May '45, pp. 455-461.

Statistical procedure designed to account for the inherent variability of a given process (e.g., spot welding) in establishing process minimums. This method provides a minimum and measurable risk against the process falling below specification quality. To use the procedure outlined, requirements must be met. These requirements discussed in detail. 7 ref.

12-113. **Testing the Quality of Steel by Magnetic Methods.** H. Sjövall. *Jernkontorets Annaler,* v. 128, no. 12, '44, pp. 610-616. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 157-A.

12-114. **The Order of Stating Elements in Analyses.** *Jernkontorets Annaler,* v. 128, no. 12, '44, p. 621. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 161-A.

12-115. **The Uses and Limitations of the Spectrograph.** J. F. McNeil. *Australasian Engineer, Science Sheet,* Dec. 7, '44, pp. 10-14. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 161-A.

12-116. **Quality Control of Metallic Arc Welds by Radiographic Examination.** John J. Chyle. *Industrial Radiography,* v. 3, Winter '44-45, pp. 13-21.

Radiographic examination primarily differentiates variations in density of matter and it is for this reason that radiographic examination is so successful in examining welds. Variation in density of weld metal is due to the presence of one or more of the following defects: Gas cavities, cracks, lamination, slag, oxides or other non-metallic inclusions.

12-117. **Adjustable Radium Capsule Support.** J. Bland and E. Banks, Jr. *Industrial Radiography,* v. 3, Winter '44-'45, pp. 23-25.

Simplicity of the gamma-ray (radium) radiographic method includes the use of simple positioning equipment for supporting the radium-containing capsule during an exposure. Function of the radium capsule support is merely to locate the radium at a fixed, previously determined distance from the film.

12-118. **A Practical Comparison of Fluoroscopy and Radiography.** R. W. Mayer. *Industrial Radiography,* v. 3, Winter '44-'45, pp. 28-35.

Emphasis is necessarily on fluoroscopy in effort to bring up-to-date knowledge of it so intelligent comparisons on the advantages of both inspection methods can be made.

12-119. **A Simplified Method of Film Evaluation.** Emery Meschter. *Industrial Radiography,* v. 3, Winter '44-'45, pp. 35-37.

Outlines the principles of a method of film evaluation which yields information on this point, utilizing a minimum of special equipment and requiring a minimum expenditure of time. Procedure has proved useful and gives results which are in good agreement with conclusions based upon practical experience.

12-120. **Industrial Radiation Hazards.** C. B. Braestrup. *Industrial Radiography,* v. 3, Winter '44-'45, pp. 37-41.

Safeguards consist in reducing the unwanted, or stray, radiation to a negligible amount, preventing superficial injuries. Summary of experiences gained from stray radiation surveys of about 60 industrial installations using voltages from 30 up to 1000 kv. and gamma rays. 12 ref.

12-121. **X-Ray Diffraction—an Industrial Tool.** J. S. Buhler. *Industrial Radiography,* v. 3, Winter '44-'45, pp. 41-44.

Describes equipment and discusses its industrial applications.

12-122. **Interpretation of Radiographs.** *Industrial Radiography,* v. 3, Winter '44-'45, pp. 44-45.

Stress is laid on the necessarily complementary parts played by visual inspection and radiography in assessing quality of castings. Attempts at quantitative interpretation are commented upon.

12-123. **Quality Control.** H. L. Collins and R. W. Callon. *Canadian Metals and Metallurgical Industries,* v. 8, May '45, pp. 20-25.
Equipment and methods used in control and development laboratories. 5 ref.

12-124. **The Use of Radio-Frequency Apparatus in Inspection.** James Cornelius. *Machinery* (London), v. 66, May 3, '45, pp. 473-476.
Radio-frequency apparatus to measure one-thousandth part of a millionth of an inch and instrument by which this variation can be detected is described.

12-125. **Specifying Steel by Performance.** G. V. D. *Machinery* (London), v. 66, May 3, '45, pp. 487-488.
Jominy test; procedure of test.

12-126. **Testing Non-Ferrous Metals by New Magneto-Inductive Method.** W. Schirp. *Elektrotechnische Zeitschrift,* v. 64, no. 31/32, August 12, '43, pp. 413-415. *Engineers' Digest* (American Edition), v. 2, May '45, pp. 238-240.

12-127. **Magnetic Powder Inspection and Its Practical Application.** J. W. Jenkins and K. D. Williams. American Society of Naval Engineers *Journal,* v. 57, May '45, pp. 166-187.
Sub-surface defects; shaft surfaces other than journal areas; surface of journals; gear tooth surfaces; proof of method; test procedure; test rotors; magnetic flux densities in crack detection.

12-128. **Magnaflux Testing of Steel Castings.** American Society of Naval Engineers *Journal,* v. 57, May '45, pp. 256-260.
Classification of castings for application of radiographic standards; electric current requirements; test specifications; interpretation of tests; complementary testing; detection of cracks. (From *Marine Engineer,* Nov. '44.)

12-129. **Quality Control Applied to Die Casting.** *Aircraft Production,* v. 7, May '45, pp. 216-218.
Novel use as a check against porosity during manufacture.

12-130. **The Choice of Engineering Materials.** M. L. Yates. *Steel Processing,* v. 31, May '45, pp. 319-320.
Use of standards; price and cost.

12-131. **Controlling Quality by Statistical Methods.** Joseph Manuele. *Steel,* v. 116, June 11, '45, pp. 123-124, 164, 168, 170.
Operating procedures.

12-132. **Lens Inspection Stepped Up With a Compact Instrument.** William S. Mazar and Walter Wallin. *American Machinist,* v. 89, June 21, '45, pp. 96-97.
Inspector lays the test piece on a guide and turns an eyepiece located at a convenient height.

12-133. **Air Gages Speed Inspection.** W. J. Hargest. *American Machinist,* v. 89, June 21, '45, pp. 114-118.

Demands in Britain for greater economy of labor and faster inspection of precision machined parts gave impetus to improvement and extended use of pneumatic gages, originally developed in Australia to operate at 1 psi. pressure. British gages use 30 psi. air pressure. The principles involved in their operation, and the application of these principles to gages for checking 20-mm. shell, cartridge case caps, and mica film thickness are described.

12-134. **Statistical Control of the Manufacture of Steel Tank Shoes.** A. E. R. Westman and R. W. S. Freeman. *Canadian Metals and Metallurgical Industries,* v. 8, June '45, pp. 38-43.

Account of the methods applied and the control achieved during the past ten months.

12-135. **American - British-Canadian Screw Thread Standards Being Coordinated.** *Screw Machine Engineering,* v. 6, June '45, pp. 50-51.

Second progress report.

12-136. **How the Hercules Powder Company Purchases Stainless Steels.** W. L. Hewes. *Steel,* v. 117, July 9, '45, pp. 100-101, 134, 136, 138, 140, 142, 148, 150, 152, 154.

Development of satisfactory working specifications and tests for steels for use in chemical processing are described.

12-137. **X-Ray in Postwar Era.** *Steel,* v. 117, July 9, '45, pp. 102-103, 156, 158, 160.

Inspection medium's relatively brief history replete with achievements. More efficient use of metals, fewer rejections, and lower costs through proper design make strong argument for X-ray expansion in next few years.

12-138. **Standardization of Shackles.** *Iron Age,* v. 156, July 12, '45, pp. 50-54.

A fatal accident resulting from the failure of a wire rope sling shackle, led to an extensive investigation of drop forged shackle quality and the drawing up of rigid specifications for inspection and test, out of which it is hoped a national standard will eventually be developed.

12-139. **Radiography as a Control of Quality in Die Castings, I.** E. T. Kilbride. *Die Casting,* v. 3, July '45, pp. 68-70, 72.

How a producer of die castings uses X-ray in the development of a proper die design and casting technique.

12-140. **Development of Stereoscopic Photography and Radiography.** Leslie P. Dudley. *Light Metals,* v. 8, June '45, pp. 259-269.

Important phases in the history and development of stereoscopic photography and radiography. Certain processes for the production of stereoscopic pictures which do not entail the use of individual viewing devices are discussed in greater detail. Some new proc-

esses, whereby stereoscopic radiographs of the parallax panoramagram type are produced, are described for the first time.

12-141. **Hardenability Band Data Set Up for 35 More Steels.** *Steel,* v. 117, July 16, '45, pp. 116-121.

Joint committee of Society of Automotive Engineers and American Iron and Steel Institute add three nickel, two chromium-nickel, five nickel-molybdenum and 25 NE steels to the "H" group. Data for complete standard steel list now being prepared. Bands based upon present chemistry will be set up later.

12-142. **Casting Inspection.** E. J. C. *Machinery* (London), v. 66, June 14, '45, pp. 649-651.

Foundries dealing with large castings definitely cannot afford to have rejected work and have developed design, molding and casting technique and methods of supervision to such a degree that rejects are exceptional. Careful visual inspection is made and soundings are taken after cleaning or sandblasting. Application of certain modern developments described; assists examination of large castings to a far greater degree.

12-143. **Infra-Red in Industry.** D. H. Killeffer. *Scientific American,* v. 173, July '45, pp. 40-43.

By harnessing forces that act outside the bounds of human senses, and applying electronic amplification, chemical control methods have been highly refined. The infra-red technique is not yet in wide use, but successful results so far point to broad future fields.

12-144. **Inspection Efficiency.** J. C. Edwards and W. A. Bennett. Institution of Mechanical Engineers *Journal,* v. 152, June '45, pp. 69-75.

Outlines numerous directions in which improvements can be sought in engineering inspection. Shows how direct improvements in efficiency can be effected by carefully planned methods of recording results, including the use of statistical quality control, by adopting the principles of time and motion study in the planning of flow of work through inspection, and in the design of gaging fixtures and the arrangement of gages.

12-145. **The Application of Statistical Methods to the Control of Industrial Costs.** Norman R. Neal. Institution of Mechanical Engineers *Journal,* v. 152, June '45, pp. 76-81.

Quality control studies the variation from standard of tangible articles, whereas "cost control" studies the variation from standard of the workers' efficiency, and consequent variation in production cost. In essence, the system consists in setting standard times, and thus standard costs, for all jobs and for the elements making up the complete jobs.

12-146. **Sampling Schemes for Qualitative Inspection.** A. W. Swan. Institution of Mechanical Engineers *Journal,* v. 152, June '45, pp. 81-92.

Applications of "qualitative" inspection. Industrial and theoretical factors affecting the choice of a sampling scheme for qualitative inspection are discussed,

particularly producer's and consumer's risk. Concludes with instructions on when and how to change to more severe sampling conditions, when results from successive samples show a deterioration in quality and the need to keep the new conditions in force until there is satisfactory evidence that the quality has improved again to the process average.

12-147. **Controlling Quality of Steel Castings.** John W. Juppenlatz. *Iron Age*, v. 156, July 19, '45, pp. 50-54.

Although many non-destructive tests are now in commercial use for checking the soundness of steel castings, high quality is something that must be built into the product rather than inspected into it. Many inspection checks, while too costly except for the most critical castings, do serve to prove pilot methods which can be maintained in production under proper controls. Radiographic tests; fluorescent method; design precautions; heat treating factors.

12-148. **General Properties of Industrial Radiographic Films.** Herman E. Seemann. American Society for Testing Materials *Bulletin*, no. 134, May '45, pp. 17-27.

Film characteristics; interpretation of the characteristic curve; factors influencing the shape of the characteristic curve; fog; graininess; processing.

12-149. **Rationalization of Aluminum Alloy Specifications.** A. E. Russell. Royal Aeronautical Society *Journal*, v. 49, no. 409, Jan. '45, pp. 14-20. *Engineer's Digest* (American Edition), v. 2, June '45, pp. 295-298.

Survey of the progress made puts the facts in their proper perspective.

12-150. **Simplified Inspection of Thread Gages.** F. W. Boeckel. *Tool Engineer*, v. 14, June '45, p. 29.

A simple fixture, in combination with 3-wire method, provides easy checking of pitch diameters of pipe thread gages.

12-151. **Castings Inspection and Qualifications of Inspectors.** A. K. Higgins. *American Foundryman*, v. 7, July '45, pp. 38-39.

Qualities most desirable in a foundry inspector listed.

12-152. **Steel Castings Radiography.** E. L. LaGrelius. *American Foundryman*, v. 7, July '45, pp. 46-56.

Discusses the application of general principles of radiography in the foundry.

12-153. **Statistical Control—the Yardstick of Performance.** Roger W. Bolz. *Machine Design*, v. 17, July '45, pp. 135-138.

Statistical methods of investigation and control provide the fundamentals for the quality gage of a production machine. Problems avoided by statistical analysis.

12-154. **Metallurgical Factors of Underbead Cracking.** S. L. Hoyt, C. E. Sims, and H. M. Banta. *Metals Technology*, v. 12, June '45 T. P. 1847, 24 pp.

Relative underbead cracking tendencies of hardenable steels may be determined by a simple weld test

made under carefully controlled conditions. Extent of underbead cracking, crack sensitivity, can be correlated with the dilatometric characteristics. Structure, as determined by the manufacturing and thermal history of the steel, has a marked effect upon the weld-crack sensitivity. 4 ref.

12-155. **Weldment Inspection Methods, II.** *Industry & Welding,* v. 18, July '45, pp. 40, 46, 48-51.
Destructive tests; bend test, trepanning; impact; chipping.

12-156. **The Precision 60° V-Block.** A. N. Appleby. *Machinery* (London), v. 66, June 21, '45, p. 675.
Suggests that, in addition to the normal uses to which V-blocks can be applied, if the block is made with a 60° included angle, many more uses present themselves.

12-157. **Electric Gaging Methods.** H. C. Roberts. *Instruments,* v. 18, July '45, pp. 462-465, 484, 486.
Potentiometric circuits; indicators and detectors.

12-158. **What the Executive Should Know About Quality Control.** Eugene Caldwell. *Steel,* v. 117, July 30, pp. 88, 90, 92.
Control of product quality is not confined to the inspection department but should govern the course of components from raw materials stage through to final assembly.

12-159. **Ciné Radiography.** S. L. Fry. *Metal Industry,* v. 67, July 6, '45, pp. 2-6.
Application to the investigation of metal pouring.

12-160. **Specification-Purchasing of Die Castings.** Herbert Chase. *Metals & Alloys,* v. 22, July '45, pp. 76-80.
Specifications used and their application to the purchasing of aluminum, magnesium and zinc alloy die castings.

12-161. **Sectional Radiography.** Robert Taylor. *Metals & Alloys,* v. 22, July '45, pp. 99-101.
Radiography of materials such as aircraft castings either for quality acceptance or for processing control is often complicated by the difficulty in determining the depth of defects indicated. Problem solved by the use of "sectional radiography" which is described along with a discussion of the equipment needed and the practical results obtained. 4 ref.

12-162. **Correlation Methods Applied to Steel Problems.** *Western Metals,* v. 3, July '45, p. 21.
Precautions using statistical analysis.

12-163. **Specification Requirements for Spark Testing of Insulated Wires.** *Wire & Wire Products,* v. 20, Aug. '45, pp. 566-568.
Study of electrical characteristics and speed of operation of relay of a sparker.

12-164. **Method for Checking Flush Pin Gages.** Frank Brown. *Production Engineering & Management,* v. 16, Aug. '45, p. 97.
Can be readily checked with a ground, hardened steel

block as shown. Actual dimensions of the block illustrated are ⅜ in. thick, 1½ in. high and 2 in. long.

12-165. **Checking the Thickness of Cylinders by Electrical Methods.** B. M. Thornton. *Machinery* (London), v. 67, July 5, '45, pp. 9-11.

Method of testing; results of test; the importance of wall thickness.

12-166. **Preliminary Investigation of Metal Pouring by Cine Radiography.** S. L. Fry. *Foundry Trade Journal,* v. 76, July 12, '45, pp. 213-216.

Method with great possibilities for the practical foundryman, the die caster, and the metallurgist.

12-167. **Ciné Radiography.** S. L. Fry. *Metal Industry,* v. 67, July 14, '45, pp. 25-28.

Application to the investigation of metal pouring.

12-168. **Photography for Research.** S. H. Thorpe. *Iron & Steel,* v. 18, July '45, pp. 219-225, 240.

Methods used in research work in applications in the steel industry.

12-169. **Preliminary Investigation of Metal Pouring by Ciné Radiography.** S. L. Fry. *Foundry Trade Journal,* v. 76, July 19, '45, pp. 239-244.

Positive prints of the fluorescent screen for purpose of description can be divided into three tones; namely, light, medium and dark. The lightest tone, the area receiving the most X-rays, is the empty mold and runner shape. The surrounding area of medium tone is the sand comprising the remainder of the mold, while the almost black tones are the areas of metal.

12-170. **Radiography as a Control of Quality in Die Castings. Part II.** George Mullowney. *Die Casting,* **v. 3,** Aug. '45, pp. 60-62, 64.

Guide for the interpretation of X-ray negatives, for the user of die castings.

12-171. **Research and Quality Control of Materials.** E. H. Gurney. *Tool Engineer,* v. 14, July '45, pp. 42-46.

Thorough knowledge of quality factors provided by research, is basis of control system which assures marked increase in uniformity of product.

12-172. **Radium Examination of Welds.** Joseph S. Harris. *Welding Engineer,* v. 30, Aug. '45, pp. 40-43.

Radiography with radium has become a thoroughly tested and approved method of uncovering defective welds; tells how it is being used in structural welds, pressure vessels, machinery welds and casting repairs.

12-173. **X-Raying of Magnesium Test Bars.** Robert Taylor. *Aero Digest,* v. 50, Aug. 1, '45, pp. 101, 170.

Examines test bars for sub-surface discontinuities before subjecting them to the destructive physical test. X-ray inspection invaluable for determining, prior to physical testing, whether or not the bar itself is sound.

12-174. **X-Rays and Industrial Diamonds—II.** E. J. Tunnicliffe. *Industrial Diamond Review,* v. 4, Dec. '44, pp. 271-273. *Engineers' Digest* (American Edition), v. 2, July '45, pp. 333-334.

Investigations on tools tipped with shaped diamonds, together with brief notes on the conditions disclosed. Projecting sections of the mounted stones appear to have irregular contours. This is due to a film of vaseline covering the complete workpiece, the purpose of which was to protect them against the lead solution used for masking unwanted primary and scattered X-rays.

12-175. **Quality Control. Part II.** H. L. Collins & H. Shehyn. *Canadian Metals & Metallurgical Industries,* v. 8, July '45, pp. 20-25, 38.

Chemical laboratories; sampling and sample preparation; organization of control work; laboratory design; methods of analysis; analysis of ores; fluoride materials; miscellaneous raw materials; carbon materials; analysis of aluminum and alloys. 21 ref.

12-176. **Radiography Improves Foundry Technique.** *Canadian Metal & Metallurgical Industries,* v. 8, July '45, pp. 33-34, 36, 39, 48.

Summary of work carried out on the improvement of castings in a large foundry, the development being checked by radiography at each stage until a sound or serviceable casting was obtained. Rapid means of assessing the results by radiography enabled the working of the various alterations to be followed without the alternative expensive and cumbersome method of cutting-up.

12-177. **Gages for Quality Control.** Robert M. Hays. *Western Machinery & Steel World,* v. 36, July '45, pp. 312-313.

Use and care.

12-178. **Metal Thicknesses Determined by X-Ray.** *Steel,* v. 117, Aug. 13, '45, pp. 114, 162, 164.

Radiographic technique successfully applied to thickness measurements on hollow steel propeller blades. Possible applications include plate, tubing and strip.

12-179. **Special Double Gage Set-Up Speeds Inspection of Small Parts.** *American Machinist,* v. 89, Aug. 16, '45, pp. 102-105.

Inspectors can use both hands for simultaneous checking of two pieces. Gage combinations likewise speed inspection work.

12-180. **The Control of Tropenas-Converter Blowing by a Direct-Vision Spectroscope.** S. T. Jazwinski. Iron & Steel Institute, Advance Copy, June '45, 4 pp.

Development of a converter flame during the blow and the appearance and disappearance of certain lines of the spectrum observed through the direct-vision spectroscope. Definite relationship between the bands in the flame spectrum and the composition of the metal in the bath. This leads directly to the application of the "electric eye" to the Tropenas converter to attempt a more rigid control of the process.

12-181. **Fifty Years of Testing Service.** Charles B. Bryant. *Railway Age,* v. 119, Aug. 18, '45, pp. 289-292.

Southern's test department controls the quality of

the materials purchased, investigates possibilities of new application and studies general product-serviceability.

12-182. **Special Tools Standardized.** *Screw Machine Engineering,* v. 6, Aug. '45, pp. 76-78.

Some of the major advantages which can be secured by users of carbide tools, when "standard items" are employed.

12-183. **Quality Control, Part III.** A. Hone and E. Pearson. *Canadian Metals and Metallurgical Industries,* v. 8, Aug. '45, pp. 24-28, 45.

Metallography. Control during casting; constituents; constituent distribution; grain size; grain flow; control during heat treatment; anodic coatings.

12-184. **Reducing Defective Material and Inspection Time by Statistical Quality Control.** *Canadian Metals & Metallurgical Industries,* v. 8, Aug. '45, pp. 33-36.

Use graphic methods to picture what is going on in a process. Let everybody in the plant know what is going on. Determine the significance of operation test results by statistical methods. When it is necessary to reduce undesirable deviations in quality, consider library research, laboratory research, planned experiments, and process correlation. Determine the amount of inspection necessary, using scientific methods. Cost data in graphic form.

12-185. **Metallography a Light Metal Inspection Tool.** *Light Metal Age,* v. 3, Aug. '45, pp. 17-19.

Advantages offered by metallographic inspection as a control of die casting quality summarized. Qualifications of a metallographer, metallographic techniques, the equipment necessary for installation of a metallographic laboratory, and concrete applications of this type of inspection are considered.

12-186. **High-Speed X-Rays.** Charles M. Slack, C. T. Zavales, and Edward R. Thilo. *Steel,* v. 117, Sept. 3, '45, pp. 114-117, 150, 152, 155-156, 158, 160, 162.

Field emission arc cathode eliminates need for long exposures, making X-rays useful for investigation of mechanical and metallurgical phenomena. Presents history of tube and circuit development, and description of equipment.

12-187. **Trepanning Welded Joints for Defects.** J. B. Arthur and M. H. MacKusick. *Iron Age,* v. 156, Sept. 6, '45, pp. 80-82.

Although a destructive type test and covering small areas, trepanning is a valuable welding inspection tool for revealing certain critical defects not detectable by other methods. The combination of trepanning and X-ray appears to be the ideal inspection procedure. Interpretation of photographs of plugs removed from welds by trepanning can readily be done by welders of average skill.

12-188. **Quality Control, Part III.** A. Hone and E. Pearson. *Canadian Metals & Metallurgical Industries,* v. 8, Aug. '45, pp. 24-28, 45.

Extreme care should be exercised to ensure that the structure is in no way altered from the original state through deformation by shearing or bending or overheating by sawing or machining. Care must be taken in all the stages of polishing to prevent flow which will obscure the true structure of the metal. Control during casting; constituents; constituent distribution; grain size; grain flow; control during heat treatment; anodic coatings.

12-189. **New Management Method for Industrial Processes.** H. H. Fairfield. *Canadian Metals & Metallurgical Industries,* v. 8, Aug. '45, pp. 32-36.

Reducing defective material and inspection time by statistical quality control.

12-190. **Something New in Remote Control for the Steel Industry.** Theodore J. Kauffeld. *Sheet Metal Industries,* v. 22, Aug '45, pp. 1356-1359, 1366.

Desires to stimulate engineering thought in the steel industry as to the practical application of this most versatile, accurate and relatively inexpensive piece of equipment which, although combat tested, is now making its debut in many other industrial applications such as in the fields of industrial equipment, electronic devices, marine apparatus, aircraft control.

12-191. **Relationship of X-Ray Inspection to Light Metals Foundry Control.** Robert Taylor. *Aluminum & Magnesium,* v. 1, Aug. '45, pp. 20-24.

Acceptance standards; radiographic interpretation; value of X-ray control; defects—their causes and their appearance in the radiograph; X-ray technique. 4 ref.

12-192. **Automatic Film Processing at Willow Run.** Merle F. Valade. *Industrial Radiography,* v. 4, summer '45, pp. 13-17.

Description of process. (Paper for American Industrial Radium and X-Ray Society.)

12-193. **Technique and Terminology Highlights.** Maynard B. Evans. *Industrial Radiography,* v. 4, summer '45, pp. 18-25.

Remarks directed toward the light alloy casting fields of industry; radiographic technique; the X-ray exposure; kilovoltage; milliamperage; time; distance; contrast; latitude; sensitivity; detail; distortion; density; objectionable factors; filtration; screens; film; darkroom processing; developing.

12-194. **A Simple Method for Producing Duplicate Radiographs.** Stuart D. Herbein and James F. McKenna, Jr. *Industrial Radiography,* v. 4, summer '45, p. 28.

Original negative is reproduced on a special type film by a single contact printing exposure. Known as the light reversal process, it is based on massive over-exposure of a special type film.

12-195. **X-Ray Micrography as a Tool for Foundry Control.** Leslie W. Ball. *Industrial Radiography,* v. 4, summer '45, pp. 29-36; also *Metal Industry,* v. 67, Aug. 24, '45, pp. 130-134.

Briefly traces the use of X-ray micrography and shows that with the proper equipment and technique procedure

can be simplified. Shows the microcavities can be studied in sufficient detail to enable their proper diagnosis and correction; also shows that an identification library of radiographs together with corresponding micrographs can be provided to assist X-ray interpreters in making decisions regarding castings.

12-196. **Principles of Protection in Industrial Radiography.** Roy M. Seideman. *Industrial Radiography,* v. 4, summer '45, pp. 37-41.

Principles involved in the use of Roentgen rays and gamma rays are based on the penetrating and resolving powers of these rays; biologic effects; medical aspects; tolerance; protection.

12-197. **High-Speed X-Rays.** Charles M. Slack, C. T. Zavales and Edward R. Thilo. *Steel,* v. 117, Sept. 10, '45, pp. 120, 122.

Field emission X-ray technique used to study action of projectiles at Frankford Arsenal may provide means to radiograph valve components in operation and other industrial subjects. It is readily adapted to the taking of high speed "flash" photographs.

12-198. **Statistical Methods in Quality Control. Part IV. Subgrouping of Data—Finding Causes of Trouble.** *Electrical Engineering,* v. 64, Sept. '45, pp. 328-329.

Analysis of raw materials, machines, and men as the three basic causes of variations in processing, and a recommendation for subgrouping of inspection and test data.

12-199. **Gages for Quality Control.** Robert M. Hays. *Western Machinery & Steel World,* v. 36, Aug. '45, pp. 350-351.

Thread plug gages.

12-200. **Lot-by-Lot Inspection for Quality Control.** A. L. Atherton. *Tool & Die Journal,* v. 11, Sept. '45, pp. 122-125.

Advantages and opportunities summarized.

12-201. **Applications of Metallographic Techniques to Engineering Design and Quality Control.** P. Leckie-Ewing. *Western Miner,* v. 18, Sept. '45, pp. 49-52.

Metallography is the study of the internal structure of metals. Many of the techniques have a direct and simple application to the selection and evaluation of metallic materials and to the quality control of metallic products. Fracture testing; hardness testing; macro-examination; micro-examination; torsion failure of steel bar; fatigue failure of coal picks; fatigue failure of generator drive shaft; defective sprayed metal coating; low elongation of steel castings; poor machinability of free-machining bolt stock; development of induction heat treatments; examination of bronze bushings.

12-202. **Gage Control.** W. F. Johnson. *Iron Age,* v. 156, Sept. 20, '45, pp. 68-71.

Gages can never be more precise than the system by which their accuracy is controlled. Selection, maintenance, care and control of gages and tools becomes of importance in any production of quality program. System of gage and tool control described.

12-203. **Talks About Steelmaking Shaping Specifications.** *British Steelmaker,* v. 11, Sept. '45, pp. 400-408.

Tensile strength; elongation; reduction of area; tensile strength and Izod; tempers; chemical analysis; 1920 report; standard specifications.

12-204. **Statistical Method Lowers Inspection Costs.** Garth B. Harris. *Die Casting,* v. 3, Sept. '45, pp. 63-64, 66.

Statistical method ideally suited to manufacturers using die castings because of the large quantities usually involved. Method not only simplifies inspection operations but increases output with lower costs.

12-205. **Gages and Inspection Systems.** Anders Jansson. *Tool Engineer,* v. 15, Sept. '45, pp. 36-44.

Intended to introduce typical systems to readers, without bias or favor; descriptions, while necessarily brief, present the essential principles of the devices shown.

12-206. **Gray Cast Iron.** T. E. Barlow and C. H. Lorig. *American Foundryman,* v. 8, Sept. '45, pp. 57-63.

Tensile strength, as one measure of gray cast iron quality, and Brinell hardness and chemical composition as alternate specifications for gray iron engineering applications, do not necessarily result in irons produced under various conditions being of the same quality and possessing the same properties. The need for a simple method of correlating and interpreting these properties of gray cast iron to permit of more accurate applications is apparent. 1 ref.

12-207. **Quality Control During Production of Electric Resistance Welded Tubing.** Sidley O. Evans. *Welding Journal,* v. 24, Sept. '45, pp. 805-810.

Tests performed to maintain weld quality so consistently that the rejections resulting from couponing and hydrostatic testing each length of pressure tubing have averaged less than 0.3% of the tubes tested month after month. The effectiveness of these tests depends not so much on the remarkable features of any one test as on the coordination of the group of tests to the characteristics of the mill.

12-208. **Considerations Involved in Establishing a World Standard for Screw Threads.** William T. Taylor. *Aero Digest,* v. 51, Oct. 1, '45, pp. 68-70, 109, 113.

Optimum helix angle; crest and root design; various thread forms; effecting interchangeability; application of various threads.

12-209. **Magnetic Particle Testing.** E. H. Horstkotte and S. L. Rizzo. *General Electric Review,* v. 48, Oct. '45, pp. 24-30.

Quickly applied method of non-destructive testing reveals hidden flaws during manufacturing operations.

12-210. **"H" Steels and Their Specification.** L. E. Ekholm. *Metal Progress,* v. 48, Oct. '45, pp. 673-683.

Conditions for standard hardenability specifications. Chemical compositions of "H" steels are given—that is, steels melted to definite hardenability limits. Tentative hardenability bands are reproduced for 62 steels.

12-211. Impact of War on Non-Ferrous Specifications. Carter S. Cole. *Metal Progress*, v. 48, Oct. '45, pp. 684-692.

What after-effect will wartime specifications, substitutions and down-grading have. Aluminum and magnesium; copper; tin; zinc.

12-212. Drawing Specifications. H. J. Griggs. *Aircraft Production*, v. 7, Sept. '45, pp. 444-445.

Consideration of rational specification and requirement in surface finish.

12-213. Quality Control, Part IV. J. K. E. Cox. *Canadian Metals & Metallurgical Industries*, v. 8, Sept. '45, pp. 20-24, 47.

Radiography; X-rays and radiographs; sensitivity of radiography and the establishing of a radiographic technique; the interpretation of radiographs; development of foundry technique; laboratory design and equipment; safety precautions; routine system for the radiographic inspection of castings.

12-214. Radiography as a Control of Quality in Die Castings. Part III. Leo C. Kotraschek. *Die Casting*, v. 3, Oct. '45, pp. 68, 70, 72, 74.

Describes the operating principles of fluoroscopic equipment and includes specific recommendations for its efficient use.

12-215. Progress Report on Hardenability Bands. John Mitchell. American Iron and Steel Institute Yearbook, Advance Copy, 1945, 34 pp.

Pooling their wartime experience, consumers and producers of alloy steels have completed the first phase of a joint investigation of an improved method of specifying and testing various types of alloy steels. The method includes chemical analysis and approximates actual conditions of use. Both prewar and NE steels included.

12-216. Practical Application of Statistical Methods in a Quality Control Program. W. T. Rogers. American Society for Metals Preprint 23, 1945, 23 pp.

Presents examples of the application of statistical methods in a quality control program. Three general methods of handling routine data are discussed: Frequency distributions, control charts, and correlation, with a number of actual examples demonstrating each application. Advantages of the control chart method of presenting data are compared to those of the frequency distribution in both routine and experimental problems, and the inadequacy of the frequency distribution is pointed out. Problems in simple and multiple correlation, taken from actual experience, are presented, with a final example showing the results of a coordination of correlation and control charts. 9 ref.

12-217. Detection, Causes and Prevention of Injury in Ground Surfaces. L. P. Tarasov. American Society for Metals Preprint 26, 1945, 53 pp.

Methods of detecting cracks, stresses and burn in ground surfaces are discussed. Description of cracks and crack patterns that have been observed in practice, including

both the cracks that occur spontaneously during or after grinding and the etch cracks that can be developed by suitable etching from stresses introduced into the surface during grinding. Metallurgical factors are considered that have been repeatedly shown to cause hardened steels to be susceptible during grinding to trouble from cracking or from unduly high stressing. Numerous grinding factors are taken up, and specific examples are presented regarding the influence of some of the more important ones upon possible injury to the ground surface. Methods are discussed by which undesirable stresses may be eliminated from ground surfaces after grinding.

12-218. **Testing of Precision-Lathe Spindles.** G. M. Foley. American Society of Mechanical Engineers *Transactions,* v. 67, Oct. '45, pp. 553-556.

Describes the development and operation of spindle-testing equipment capable of measuring continuously and at any speed changes in the position of the spindle axis relative to the quill as small as one micro-inch.

12-219. **Fluoroscopy of Light Alloy Castings.** B. Cassen and D. S. Clark. *Iron Age,* v. 156, Nov. 1, '45, pp. 54-59.

Investigation indicates that the fluoroscope using rotational scanning shows a surprisingly large number of medium and larger defects that are not detected radiographically. Also described is a superior type of protective window to take the place of the conventional lead glass window which discolors.

12-220. **Which Screw Threads Are Most Popular?** *Screw Machine Engineering,* v. 6, Oct. '45, pp. 43-46.

First steps taken to establish a listing of most used screw threads.

12-221. **Statistical Quality Control of Methods and Materials.** Edwin G. Olds. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1097-1101.

Process control; how the charts are used; visual defects and their reduction; material-acceptance sampling; applications and benefits. 20 ref.

12-222. **Purchasing Castings.** L. W. Ball. *Metal Industry,* v. 67, Oct. 5, '45, pp. 210-213.

Method for specifying quality on purchase orders for castings is based on a few simple radiographic illustrations combined with artist's sketches. Maximum acceptable degree of discontinuities based on a statistical analysis of prevailing commercial foundry standards. Method is particularly applicable to light alloy aircraft castings, but is also suitable for all other types of castings and alloys.

12-223. **A New Method of Sorting Steels and Other Alloys by Employing the Triboelectric Properties of Metals.** Antony Doschek. *Instruments,* v. 18, Oct. '45, pp. 680-681, 710, 712.

Triboelectric effect is observed through the electric current which is generated when two metallurgically dissimilar metals are caused to move in contact with each other. If the two metals are identical, no current is generated and the fact of their identity is thus manifest. Tribo-

electric voltage values range from a fraction of a microvolt to several millivolts, depending upon the chemical compositions of the metals or alloys in triboelectric union. The friction necessary to produce triboelectrification in dissimilar metals need not be great enough to rupture the surfaces on which tests are made and the disposition of the pieces being tested; i.e., whether or not they are in mechanical and electrical contact with other unlike metals, has no bearing whatever on the validity of the tests.

12-224. **Magnetic Particle Detection of Retained Austenite and Carbide Segregation.** Richard J. Dooley. *Iron Age,* v. 156, Oct. 25, '45, pp. 46-49.

Before making tools from high speed steel, inspection of longitudinal sections by the wet-continuous Magnaflux method provides a rapid and accurate indication of quality. Shows how segregations and areas with retained austenite are found by this method.

12-225. **The Technique of Macrography, II.** *Chemical Age,* v. 53, Oct. 6 ,'45, pp. 316-318.

Nital type etching media; improved contact prints; macrography of cast iron; copper alloys examined; reagents for aluminum alloys; magnesium and lead alloys.

12-226. **Aviation Inspection at Chevrolet Div. of General Motors.** *Modern Industrial Press,* v. 7, Oct. '45, pp. 26, 28, 30.

Some of the means and methods by which flood of precision-built machines was created.

12-227. **The Advantages and Limitations of Gamma-Ray Radiography on Small Steel Castings.** R. H. Frank. *American Foundryman,* v. 8, Oct. '45, pp. 50-61.

Improved methods of application and better understanding of interpretation standards have resulted in wide acceptance of radiography as an inspection tool and as a means of developing techniques to assure perfection of castings.

12-228. **Industrial Radiography.** *Automobile Engineer,* v. 35, Oct. '45, pp. 415-417.

Some of the important factors in the use of gamma-rays for industrial inspection are discussed.

12-229. **Wheel Tests Establish Standards.** *Production Engineering & Management,* v. 16, Nov. '45, p. 96.

Many factors, pertinent to the efficient operation and manufacture of canvas polishing wheels, have been developed from running tests recently conducted under actual operating conditions.

12-230. **Stress Comparisons by Correlation With High Frequency Magnetic and Eddy Current Losses.** P. E. Cavanagh. American Society for Metals Preprint 3, 1945, 27 pp.

Possibility of using a high frequency oscillator, whose output is governed by magnetic and eddy current losses, to accomplish practical comparisons of stresses in metals. Preliminary experiments described to establish the fact that high frequency core losses do correlate with internal stresses. Practical applications are divided into *(a)* comparisons of stresses arising from cold working and quenching and *(b)* prediction of fatigue failure. 13 ref.

12-231. **Alloy Steel or Alloy-Treated Steel(?)** Henry T. Chandler. *Metal Progress,* v. 48, Nov. '45, pp. 1104-1108.

Recommends that the carbon steels and that standard alloy steels be specified (as in the past) by their chemical analysis, but that no effort be made to specify a chemical analysis for the residual amounts of the reaction alloys when intensified steels are purchased. Their effects should be specified by specifying desired mechanical properties. The classification "alloy treated steels" should be revived.

12-232. **Statistical Quality Control.** John M. Howell. *Aircraft Production,* v. 7, Oct. '45, pp. 475-477.

Some American views on its fundamental concepts.

12-233. **Inspecting Forged Axles at the Le Tourneau Plant by Means of Supersonic Waves.** John C. Smack. *Automotive & Aviation Industries,* v. 93, Nov. 15, '45, pp. 32-35, 124.

Defects in interior of metals and other materials may now be located by means of non-destructive test method. Describes principle of operation of Supersonic Reflectoscope and manner in which it is applied to inspection of forged flanged type axles.

12-234. **Continuous X-Ray Inspection.** David Goodman. *Canadian Metals and Metallurgical Industries,* v. 8, Nov. '45, pp. 32-35, 52.

Results achieved with 2,000,000-volt unit at large U. S. ordnance plant.

12-235. **Correlation of Inspection Methods in the Metal Industry.** James V. Rigbey. *Canadian Metals and Metallurgical Industries,* v. 8, Nov. '45, pp. 36-40.

The older methods; non-destructive methods; radium in a field by itself; significance of radiography; other methods supplement radiography.

12-236. **Control of Radiographic Quality Through Direct Density Checks.** Alvin F. Cota. *Industrial Radiography,* v. 4, Fall '45, pp. 11-17.

System comprised three main steps: (1) Determination of readability range best suited to the work; (2) plotting a control chart; (3) correction of density changes attributable to unbalanced processing solution by addition of basic chemicals to processing solutions.

12-237. **Intensity Distribution of X-Ray Units—150-Kv. and 250-Kv.** George A. Russ. *Industrial Radiography,* v. 4, Fall, '45, pp. 22-23.

Enables radiographer to utilize X-ray beam to his best advantage and arrange set-up of objects accordingly.

12-238. **Radiography From the Metallurgical and Inspection Standpoint.** Thomas E. Caldwell. *Industrial Radiography,* v. 4, Fall, '45, pp. 28-30.

Gives general aspects of radiographic examination. Shows how producer and customer can and should use radiography.

12-239. **Precision Mass Production Technique in Industrial Radiography.** Henry A. Solow. *Industrial Radiography,* v. 4, Fall '45, pp. 31-34.

Benefits in precision, speed and economy derived from use of system.

12-240. Protection Against X-Rays and Gamma Rays. *Industrial Radiography,* v. 4, Fall '45, pp. 35-44.

The tolerance dose or tolerance intensity; radiation injury; genetic injury; human factors; X-ray protection in industrial fluoroscopy; materials and methods of X-ray protection.

12-241. Methods of Magnetic Inspection. Fred M. Burt. *Welding Engineer,* v. 30, Nov. '45, pp. 35-39.

Theory and practice and tells how it is being made to reveal invisible welding flaws.

12-242. British EN Alloy Specifications. J. H. G. Monypenny. *Iron Age,* v. 156, Nov. 15, '45, pp. 71-76.

Unique features were dependence of specifications on physical properties rather than chemical analysis, and the discretionary powers given to metallurgists to authorize use of material not meeting specifications.

12-243. Non-Destructive Testing of Steel Castings. *American Foundryman,* v. 8, Nov. '45, pp. 35-36.

Methods, developments and progress in setting up standards for non-destructive testing are reported to members of A.F.A. Steel Division. Bibliography of recent publications on destructive testing of steel castings, technique and fundamentals related to radiography of steel castings. 13 ref.

12-244. Blind Inspectors Gage by Sound. *American Machinist,* v. 89, Nov. 22, '45, p. 111.

Combination of an electric gaging head, a controllable oscillator and an aural signal generator permits blind inspectors to differentiate parts to close tolerances. Control circuits are simple. Gaging head is a standard unit that can be adjusted to suit the requirements of many dissimilar components.

12-245. X-Ray Standards for Purchasing Castings. Leslie W. Ball. *Iron Age,* v. 156, Nov. 22, '45, pp. 62-64.

Agreement on castings accepted can be greatly furthered by interpreting non-homogeneities as revealed in radiographs according to the criticalness of the area in which located.

12-246. Gamma Ray Radiography—Its Advantages and Disadvantages. R. A. Gezelius. *Aluminum & The Non-Ferrous Review,* v. 10, July-Sept. '45, pp. 43-45.

Radiographic process; inspection method selection; radiation source; gamma ray emission; large casting inspection; timing exposure; radiation intensity.

12-247. Accurate Interpretation of Radiographs. Henry R. Clauser. *Materials & Methods,* v. 22, Nov. '45, pp. 1418-1422.

Sensitivity; contrast and definition; film blemishes; viewing radiographs. 4 ref.

12-248. Radiography and Shipyard Welding. R. Halmshaw. *Welding,* v. 13, Nov. '45, pp. 451-455, 461.

Advantages of gamma-ray equipment.

12-249. Engineering Specifications. Herman Granberry. *Tool Engineer,* v. 15, Nov. '45, pp. 34-37.

Clearly defined terms and specified procedures for processing result in improved products and greater manufacturing economy.

12-250. **Inspection in the Small Plant.** J. H. Bryant. *Steel,* v. 117, Dec. 3, '45, pp. 118-119, 136.
Double-check routine proves worth in time, material, and manpower saved.

12-251. **Avoiding Air Bubbles on Specimens in Lead Salt Solutions.** H. D. Hodge. *Industrial Radiography,* v. 4, Fall '45, p. 44.
With specimens having very irregular contours, it is not easy to get air bubbles loose from the surfaces, especially from under surfaces where they are difficult to reach.

12-252. **Quartz Crystal as a Mineral Resource.** Robert B. McCormick. *Metals Technology,* v. 9, Nov. '45, T. P. 1916, 4 pp.
Inspection and grading of quartz crystal; common imperfections found in quartz.

12-253. **Checking Piston Rings.** *Steel,* v. 117, Dec. 10, '45, pp. 114, 168.
Automatic gaging machine checks at high speed both gap and periphery for any dimensions desired.

SECTION XIII

TEMPERATURE MEASUREMENT AND CONTROL (PYROMETRY)

13-1. **Temperature Impulse as a Means for Furnace Control.** C. Sieber. *Metall Wirtschaft,* v. 22, nos. 27/29, Aug. 20, '43, pp. 405-411.

The term "temperature impulse" is used to define the action of the primary measuring element in a temperature control circuit, under influence of changes in furnace temperature. Various types of primary temperature measuring elements are discussed with respect to their responsiveness, sensitivity, accuracy, and construction.

13-2. **Contact Thermometers.** *Chemical Age,* v. 51, Dec. 9, '44, pp. 545-546.

The adjustable contact thermometer will control temperatures at various points. It is provided with two scales—the upper one for adjusting and setting the movable index to any temperature desired, the lower one for measuring temperature. Adjustment is made by means of a magnet sliding over the thermometer which at the same time holds the index in position once it has been set to the desired temperature.

13-3. **Fuel Economy.** *Iron & Steel,* v. 17, Dec. '44, p. 721.

Temperature control of heating and process steam.

13-4. **Pen Cleaners for All (Who Have Hair).** A. L. Hodge. *Metal Progress,* v. 47, Feb. '45, p. 273.

Hair plucked from a human's head works for pen cleaning or priming wire when a recording pen actually fails to write.

13-5. **Heat Transfer.** G. W. Penney. *Scientific American,* v. 172, Feb. '45, pp. 101-102, 104.

Some of the fundamental science surrounding the many ways in which heat transfer is involved in the machinery of modern industry. Five different basic mechanisms for transferring heat. Many large companies maintain basic research on these problems because of their importance.

13-6. **A.S.M.E. Heat Transfer Division.** *Mechanical Engineering,* v. 67, Feb. '45, pp. 130-133.

Development, objectives, and operation.

13-7. **Temperature of Molten Steel Measured With Immersion Thermocouple.** *Iron Age,* v. 155, Feb. 22, '45, p. 65.

A platinum thermocouple pyrometer which measures the temperature of a stainless steel bath before the heat is tapped from an electric arc melting furnace, the reading being recorded by an electronic instrument. The development makes possible improvement in the quality and uniformity of stainless steels.

13-8. **Heat-Flux Pattern in Fin Tubes Under Radiation.** A. R. Mumford and E. M. Powell. *Combustion,* v. 16, Feb. '45, pp. 41-43.

Curves representing the results of temperature measurements on the semi-circumference of finned furnace tubes in a tangentially fired slagging-bottom furnace under varying conditions of slag accumulations; also a laboratory approach to the study of heat-flux pattern in which electrical measurements were employed.

13-9. **Open Hearth Bath Pyrometer**. *Canadian Metals & Metallurgical Industries,* v. 8, March '45, p. 37.

Method of measuring the temperature of liquid steel in the open-hearth furnace.

13-10. **Overshooting Prevented in Temperature Control.** M. J. Manjoine. *Iron Age,* v. 155, May 3, '45, p. 61.

Servo-type thermocouple device which increases the sensitivity and response of conventional temperature control. Consists of two thermocouples of different thermal capacity and an electric heating element, enclosed in an evacuated glass envelope.

13-11. **Nickel and Inconel Thermocouple Protection Tubes.** E. M. Kline and A. M. Hall. *Metals & Alloys,* v. 21, Feb. '45, pp. 401-403.

Report of the successful and advantageous use of nickel and inconel thermocouple protection tubes for lead pot, salt bath, and controlled atmosphere service.

13-12. **The Immersion Thermocouple in the Gray Iron Foundry**. R. C. Tucker. *Foundry Trade Journal,* v. 75, April 26, '45, pp. 335-341.

Use for the control of casting temperature, solidification range and rates of cooling. 5 ref.

13-13. **A New Thermo-Element Independent of the Temperature of Comparison Point.** Hans Thomas. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 140-141.

13-14. **Continuous Determination of Oxygen and Combustibles**. J. F. Luhrs. *Iron & Steel Engineer,* v. 22, May '45, pp. 45-53.

Rapid measurement of oxygen and combustible contents of gases offers great possibilities in the control of furnaces of all types . . . equipment has been developed to do this efficiently and accurately.

13-15. **Recording Die Temperatures.** A. H. Nicholson. *Metal Industry,* v. 66, May 18, '45, pp. 306-307.

One of the most important factors in the production of uniform die castings is the maintenance of regular

die temperatures. Describes a simple means of die temperature control.

13-16. **Symposium on Measurement of Heat Absorption in Furnaces, Part 2.** *Industrial Heating,* v. 12, May '45, pp. 772, 774, 776, 778, 806.

Measurement of the heating rate of the charge in furnaces (a correlation of direct measurements with the results obtained by the electrical analogy method) discussed.

13-17. **Symposium on Measurement of Heat Absorption in Furnaces, Part III.** *Industrial Heating,* v. 12, June '45, pp. 946, 948, 950, 952.

New method for measurement of fluid flow applicable to studies of convective heat transfer.

13-18. **The Measurement and Control of Open-Hearth Flame Radiation Intensity.** A. L. Hodge. *Industrial Heating,* v. 12, June '45, pp. 988, 990.

Measurements using a radiation receiver with a fused silica lens made at each wicket during each reversal after melting.

13-19. **Aluminum Radiamatic Housing.** *Modern Metals,* v. 1, June '45, pp. 25-26.

Aluminum chosen for the construction of housings because of its high degree of thermal conductivity and dissipation of radiant heat. The theory and principle of radiation pyrometry discussed.

13-20. **Bollenrath's Dilatometer in Practical Application.** A. Metz. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 559-561.

Several improvements and additions to the Bollenrath dilatometer are described.

13-21. **Anticipator Improves Temperature Control.** M. J. Manjoine. *Machine Design,* v. 17, June '45, p. 116.

Vacuum-tube thermocouple device increases the sensitivity and response of conventional temperature controls by 1000%; consists of two thermocouples of different thermal capacity and an electric heating element, enclosed in an evacuated glass envelope.

13-22. **Temperature of Steel Bath Measured in Five Seconds.** *Blast Furnace and Steel Plant,* v. 33, June '45, pp. 712-713.

With a modified Collins-Oseland tube equipped with a photronic cell and amplifying and recording instruments, a satisfactory temperature determination requires but five seconds. The all-steel tube in the hands of an experienced operator will last for more than a thousand readings.

13-23. **Temperature Control.** *Automobile Engineer,* v. 35, May '45, pp. 183-189.

Color registering mixtures for desired application to heated surfaces.

13-24. **168° Below Zero.** G. W. Birdsall. *Steel,* v. 116, June 25, '45, pp. 126, 128, 130, 132.

Great expansion in application of "cold" involves

much special equipment to meet the many different service requirements. Lansing plant features a variety of machines to handle metal-working in production of "cold" units.

13-25. **Industrial Use of Radiation Pyrometers Under Non-Blackbody Conditions.** Thomas R. Harrison. *Instrumentation,* v. 1, no. 5, July-Aug. '45, pp. 7-15.
Principles of radiation pyrometry; blackbody, non-blackbody, and emittance defined; radiation from a non-blackbody in the open; radiation from a non-blackbody within a heated enclosure.

13-26. **Temperature Control of Pickling Tanks.** *Instrumentation,* v. 1, July-Aug. '45, p. 22.
Principles of operation.

13-27. **Temperature Control Systems for Fuel Fired Galvanizing Kettles.** *Instrumentation,* v. 1, July-Aug. '45, p. 23.
Temperature control system for the batch process; principles of operation; placement of thermocouples; proportioning temperature control system with automatic reset for the continuing process.

13-28. **An Anticipatory Method for Improving Automatic Temperature Control.** M. J. Manjoine. *Instruments,* v. 18, July '45, pp. 454-455.
Device to eliminate excessive hunting and overshooting of temperature minimizes cyclic swings in temperature characteristic of most furnace controls by anticipating changes in the main furnace temperature and initiating corrective steps.

13-29. **Measurement of Heat Absorption in Furnaces: Part IV.** *Industrial Heating,* v. 12, July '45, pp. 1132, 1134, 1136, 1138.
Thermal conductivity of laminated metals; theory and description of apparatus; results on tests of a laminated sheet brass.

13-30. **An Electrical Analogue of the Flow of Heat in a Regenerator System.** K. Heindlhofer and B. M. Larsen. *Metals Technology,* v. 12, Aug. '45, T.P. 1798, 19 pp.
Simple electrical apparatus that, through the close analogy between the flow of heat and of electricity, enables one to solve quickly and with satisfactory accuracy many complex problems in heat flow. 5 ref.

13-31. **Furnace Temperature Control.** *Automobile Engineer,* v. 35, Aug. '45, p. 336.
Recent development giving extremely sensitive operation.

13-32. **Open-Hearth Furnace Controls.** V. Gregor. *Industrial Heating,* v. 12, Sept. '45, p. 1534.
Use of both manual and automatic control apparatus on open-hearth furnaces is discussed.

13-33. **A Completely Automatic Control of Open-Hearth Reversal.** B. M. Larsen and W. E. Shenk. *Western Metals,* v. 3, Sept. '45, pp. 54, 57.
Basic elements of the present control embrace one

"maximum" and one "minimum" time relay and a potentiometer recorder-controller, combined with switches and relays.

13-34. **Effect of Material on Heat Transfer Rate.** *Machine Design,* v. 17, Oct. '45, pp. 163-166.

Includes formulas for determining over-all heat transfer rate, thermal conductivities of metals and alloys, commonly used for heat exchange, and charts facilitating the calculation of over-all rates.

13-35. **Time-Temperature Relationships in Work Pieces.** Victor Paschkis. *Industrial Gas,* v. 24, Sept. '45, pp. 15-17, 32, 34.

Report emphasizes working with extremely high temperatures and particularly skin temperatures up to 3000° F. Question of uniformity in individual pieces.

13-36. **Adjustable Voltage Thermostat System.** W. C. Griffin. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, pp. 671-672.

Assembly described devised to be used with any one of several standard laboratory electric heaters, to be flexible in the choice of temperature, compact, and low in cost. With any standard single element heater it gives the effect of having a large fixed heater with a small auxiliary control heater. Circuit devised to supply a portion of the heater voltage continuously with an increased voltage upon demand of the thermostat.

13-37. **Temperature-Control Device for MacMichael Viscometer.** W. A. Rice. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Oct. '45, p. 676.

Devised to maintain the sample at constant temperature by immersion of the sample cup in a bath through which water is circulated continuously from a thermostatically controlled reservoir.

SECTION XIV

FOUNDRY PRACTICE AND EQUIPMENT

14-1. The Development and Production of Inoculated Cast Iron. H. P. Hughes and W. Spenceley. *Engineering,* v. 158, Dec. 8, '44, pp. 458-459.

The materials used previous to inoculation were a high phosphorus iron, two grades of low phosphorus iron (about 0.3 to 0.4% phosphorus), good-quality machinery scrap and return scrap. Similar irons were used after the adoption of the inoculation procedure, but the machinery scrap was replaced by steel scrap, so that a carbon content of between 3.2 and 3.3% should be obtained. No special pig-irons were used throughout this investigation. The corresponding analyses are shown. The comparative figures of 15 tests are given. (Paper presented at the 41st annual meeting of the Institute of British Foundrymen, Manchester, June 10, '44.)

14-2. Wartime Developments in Whiteheart Malleable Iron. G. R. Webster. *Engineering,* v. 158, Dec. 15, '44, pp. 477-480.

Foundry problems in the production of whiteheart malleable. (Presented at the 41st annual meeting of the Institute of British Foundrymen, held at Manchester, June 10, '44.)

14-3. Automobile Castings. J. B. Duncan. *Iron & Steel,* v. 17, Dec. '44, pp. 709-713.

Range of irons used in a large foundry for parts such as camshafts and crankshafts and the control necessary for their successful production.

14-4. Some General Aspects of Continuous Casting. V. Kondic. *Metallurgia,* v. 31, Nov. '44, pp. 7-9.

Continuous casting has been known and practiced for a century or more, but it is only during recent years that rapid progress has been made in its development. Today, commercial technique has been developed to permit one of many processes to be applied to a wide range of ferrous and non-ferrous metals and it is probable that further advances in technique will soon be made. Some general aspects are given in the application of continuous casting in the production of ingots or billets.

14-5. Speed of Rotation in the Centrifugal Casting Process. J. E. Hurst. *Foundry Trade Journal,* v. 74, Nov. 23, '44, pp. 233-236, 245.

Discussion on a paper presented at the annual conference of the Institute of British Foundrymen. Influence of vibration; weight of gear blank; more efficient thermal contact; apparent inconsistencies; theoretical calculations; "semi-centrifugal casting."

14-6. The Mechanized Production of Aluminum Gravity Die Castings for the Merlin Engine. John Vickers. *Foundry Trade Journal,* v. 74, Nov. 23, '44, pp. 237-244.

Resumé of production methods used is given in this installment.

14-7. Light-Metal Permanent-Mold Castings. L. F. Swoboda. *Iron Age,* v. 154, Dec. 28, '44, pp. 56-58.

Advantages afforded by the combination of the permanent-mold process and the light metal alloys promise wide-spread utilization for postwar products. (Abstract of paper presented before S.A.E. in Los Angeles.)

14-8. The Mechanized Production of Aluminum Gravity Die Castings for the Merlin Engine. John Vickers. *Foundry Trade Journal,* v. 74, Dec. 7, '44, pp. 277-283.

Advantages of gravity die casting over sand castings.

14-9. Improvements in Static Ferrous Castings Influencing Their Future Use. G. Vennerholm. *American Foundryman,* v. 7, Jan. '45, pp. 2-9.

Recent developments and improvements relating to static ferrous castings, which shculd have a beneficial effect upon their future use as an engineering material. 13 ref.

14-10. Design Proportions Affecting Qualities of Castings. J. A. Wettergreen. *Product Engineering,* v. 16, Jan. '45, pp. 27-31.

Design rules that help in the production of satisfactory castings and in the reduction of foundry costs. Original designs and redesigns are described to show that many production difficulties can be avoided both in making and in finishing the casting by understanding the variables in foundry technique and operations. 13 ref.

14-11. Sealants for Metal Castings for Varying Degrees of Porosity. R. W. Crawford and Sanford E. Glick. *Product Engineering,* v. 16, Jan. '45, pp. 53-55.

Materials and impregnation methods for various metals are discussed on the basis of requirements of a satisfactory sealant. The article gives details of a new synthetic resin-styrene copolymer solution that has high efficiency for sealing porosity in magnesium castings.

14-12. Propane Torch for Sand Mold Drying. *Western Metals,* v. 2, Dec. '44, p. 21.

Development of a new type of torch for green sand mold drying. Uses for its fuel propane gas.

14-13. The Mechanized Production of Aluminum Gravity Die Castings for the Merlin Engine. John Vickers. *Foundry Trade Journal,* v. 74, Dec. 14, '44, pp. 299-303, 307.

Advantages of gravity die casting over sand castings.

14-14. Modern Impregnating of Magnesium Castings. Harold A. Knight. *Metals & Alloys,* v. 20, Dec. '44, pp. 1625-1630.

Treatment of magnesium alloy castings to plug up their pores and make them pressure-tight. A number of impregnating agents and treatments are now available, and this article compares them generally and describes more specifically the applications and service performance of one recently developed synthetic product.

14-15. Sandslinger Molding Practice. *Iron Age,* v. 155, Jan. 11, '45, pp. 46-49, 122, 124, 126, 130, 132, 134, 136, 138, 140.

Sandslinger method of ramming mold boxes offers many advantages to the jobbing foundry. Gives uniform mold surfaces, better permeability for equal mold hardness and improved parting than other methods. Savings in manhours by the use of this mechanical device are considerable. British practice in its use, its application to specific patterns and an evaluation of its advantages when compared with hand, jolt and squeeze methods of ramming are described.

14-16. Light - Metal Permanent Mold Castings. L. F. Swoboda. *Foundry,* v. 73, Jan. '45, pp. 72-74, 176, 180, 182, 184.

Advantages and characteristics of aluminum and magnesium castings made by the permanent mold process. (Presented before the National Aeronautic Meeting of the Society of Automotive Engineers at Los Angeles.)

14-17. Mechanization Aids Good Housekeeping. Lester B. Knight. *Foundry,* v. 73, Jan. '45, pp. 76-78, 156.

Use of mechanical equipment does not guarantee a clean, orderly shop but it will help achieve it. Units which promote good housekeeping described. (Presented before the annual meeting of the Gray Iron Founders' Society at Cincinnati.)

14-18. Women Prove Capable as Bench Molders. *Foundry,* v. 73, Jan. '45, pp. 79, 173-174.

Experience at the foundry of the Saco-Lowell Shops, Biddeford, Me.

14-19. Selecting Inhibitors for Magnesium Molding Sand. L. W. Eastwood. *Foundry,* v. 73, Jan. '45, pp. 80-81, 208, 210, 212.

Types of inhibitors and their advantages and disadvantages described.

14-20. Patterns for Propellers. Herbert J. McCaslin. *Foundry,* v. 73, Jan. '45, pp. 82-84, 214, 216, 218.

In building standard type propeller blade patterns two methods of laminated construction usually employed. Difference in the two procedures lies in the thickness and the shape of the layers of the wood and the direction of the grain.

14-21. Repairing Defective Automotive Gray Iron Castings. *Foundry,* v. 73, Jan. '45, pp. 86, 160, 162, 164, 168, 170.

Gas and arc welding; nickel welding (so-called "cold welding"); general nickel welding; special repair conditions.

14-22. **Improvements in Pressure Ferrous Castings Influencing Their Future Use.** E. C. Jeter. *SAE Journal,* v. 53, Jan. '45, pp. 19-24.

Development and improvements of the centrifugal casting field, and particularly the improvements in steel centrifugal castings in the past several years. Describes briefly the air-pressure casting method. 6 ref.

14-23. **The Accelerated Cooling of Cast Steels.** J. M. Dugan and G. D. Griffiths. *Iron & Steel Engineer,* v. 22, Jan. '45, pp. 68-78.

Effects of rapid chilling of cast steel and presents a method of attaining these results in the manufacture of cast steel rolls.

14-24. **Side Feeding.** B. Gray. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 755-758.

Influence of the mechanism of freezing on steel castings.

14-25. **Core Binders.** W. Davies and W. J. Rees. *Iron & Steel,* v. 17 Dec. 7, '44, pp. 763-766.

Bonding properties of petroleum extracts and of extract and linseed oil mixtures.

14-26. **Side-Blown Converters.** P. C. Fassotte. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 767-770.

Developments in the design and use of foundry plants.

14-27. **Synthetic Moulding Sands.** W. Davies and W. J. Rees. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 774-779.

Study of grain shape in relation to properties.

14-28. **Steel Castings.** H. T. Protheroe. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 794-798.

Influence of melting conditions on physical properties.

14-29. **The Production and Founding of Inoculated High-Duty Cast Iron.** J. L. Francis. *Foundry Trade Journal,* v. 74, Dec. 28, '44, pp. 335-341.

Cooperation of the designing, pattern-making, founding and metallurgical departments. 8 ref.

14-30. **Centrifugal Casting of Gears. El.** *V.D.I. Zeitschrift,* v. 88, Feb. 19, '44, p. 100.

The process of centrifugal casting is described. Cast steel gears produced by this method have the same strength properties as forged gears.

14-31. **Rub-a-Dub-Dub—Few Men for the Tub.** G. K. Lewis. *Die Casting,* v. 3, Jan. '45, pp. 26-27, 33.

Since different machines require motors ranging in power from one-third to three horse power, provision had to be made for different sized bases on the same type of casting. This is accomplished by interchangeable cores.

14-32. Precision Casting—Its Place in Design. S. O. Fisher and E. E. George. *Machine Design,* v. 17, Jan. '45, pp. 123-126.

Potentialities of precision casting for future applications may be listed as follows: Manufacture of parts from alloys which cannot be mechanically worked either hot or cold; manufacture of parts from alloys which are difficult to forge, fabricate or machine; manufacture of intricate shapes which cannot be made by any other method; manufacture of limited quantities of materials ordinarily made by screw machine or die casting but where the number to be made does not justify a screw-machine setup or the cost of a die-casting die.

14-33. Gating and Feeding Malleable Pipe Fittings. Morris L. Hawkins. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 593-603.

Detailed description of the foundry practices for production of sand-cast malleable iron pipe fittings; careful selection of patterns and methods of gating, followed by a thorough inspection of trial castings; permanent gating arrangement for patterns mounted on a single match plate illustrated.

14-34. Heading and Gating of Malleable Iron Castings. A. J. Klimek. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 604-611.

Foundry practice; sprues; strainer cores; headers; heat concentration; metal turbulence.

14-35. Gating and Heading. C. C. Lawson. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 612-622.

Many points are to be considered before gating a pattern if success is to be attained. Success in this field remains the exclusive property of the skilled practical man. Pattern design; shrinkage; dendrites and cracks; time wasted; loose patterns; gating; cold iron; elimination of slag and dirt; skim cores; added fillets.

14-36. Gating and Feeding of Malleable Iron Castings. A. T. Jeffrey. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 623-631.

Factors that influence the location and use of gates and feeders in the production of malleable iron castings. General rules modified by foundry operating conditions as well as by casting design. Discusses the variables encountered in foundry practices and illustrates the gating and feeding problems of various types of castings. Importance of considering molding sand conditions is particularly emphasized.

14-37. Gating Malleable Castings. D. I. Dobson. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 632-642.

In the gating of a malleable casting, first consideration is to obtain a good sound casting. Questions of yield, flask size, and practicability of gate removal should be considered and weighed against each other

when there is a choice of one or more gatings which produce an equally sound casting. Attempt made to illustrate these points, and to show gatings for castings which most malleable men recognize as being vital to our armed forces.

14-38. **Heading and Gating Malleable Castings.** E. F. Waterbor. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 643-648.

Description of a method of heading and gating malleable castings and the application of this method to a particular casting, produced on a large scale with good results. This system has done much to enable the foundry to make sound castings and eliminate heavy feeders.

14-39. **Heat Flow Problems in Foundry Work.** Victor Paschkis. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 649-670.

Discussion of the more common thermal problems encountered in foundry work. Analogy method, which permits the solution of such problems. Application of the electric analogy method. The optimum size of the opening in the sand core between the casting and the feeding head of the casting. 10 ref.

14-40. **Alterations in Cast Iron Properties Accompanying Use of a Strong Inoculant of the Silicon-Manganese-Zirconium Type.** C. O. Burgess and R. W. Bishop. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 671-710.

Ladle inoculation has been found to produce cast irons of uniformly high physical properties of low chilling characteristics. Marked reduction in chill or wall sensitivity following inoculation has materially extended the composition range within which gray irons are resistant to chilling. The cast irons covered a carbon range of approximately 2.75 to 3.40% and a silicon range of 1.0 to 2.5%. A relatively low carbon content was indicated as essential for development of optimum mechanical properties. Essential functions of an inoculant, and tests made to determine the suitability of the silicon-manganese-zirconium inoculant employed.

14-41. **Reproducibility of Elevated Temperature Sand Test Results.** John A. Rassenfoss. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 711-732.

Study to determine the accuracy with which elevated temperature compression strength results can be reproduced at a single laboratory and between different plant laboratories. Five different sand mixes were made in triplicate at a single laboratory and tested at 2500° F. Results obtained for single batches in a series deviated from the average of the three batches made per series by 15% or less.

14-42. **Mold Surface Gas Pressure.** H. W. Dietert, R. L. Doelman and R. W. Bennett. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 733-749.

In the mold surface conditions existed which are described as hot permeability, gas volume back gas pressure, and mold gas flow. This subject presents a larger number of possible pitfalls since the amount of exact data and their correlation are rather limited in present-day literature.

14-43. **The Elimination of Micro-Shrinkage by Accurate Thermal Dissipation.** Henry F. Hagemeyer. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 758-766.

New processes enable closer control of direction of heat dissipation, and this tends to eliminate micro-shrinkage. Metal resources must be conserved and production of castings approaching the theoretical maximum of sum total physical properties would contribute to that end. Discusses the thermodynamic approach to the problem and lists 16 factors which must be considered to produce such castings. Mold material considerations, gating and risering, location of cavities in the mold, solidification and mold cooling possibilities.

14-44. **Maintenance of Equipment.** Frank J. Dost. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 784-788.

Investigation of the maintenance set-up in the plant will prove to be profitable.

14-45. **Brazil Produces Steel Castings to Replace Forgings and Fabricated Parts.** Henryk Zimnawoda. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 871-883.

Describes castings produced to replace forged or fabricated parts, and the details of methods of molding, pouring, and heat treating these castings.

14-46. **Castings From the Consumers' Viewpoint.** L. A. Danse. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 884-888.

What the fabricator may expect in the future as to quality and cost.

14-47. **Special Low Carbon Steel for Castings.** C. G. Lutts and J. P. Hickey. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 904-912.

Study of the hot-tearing tendencies, disclosed by magnetic powder testing, in the bores of certain cast steel valves and fittings. Presents the results of investigations on the use of a special low-carbon steel as a hot-tear prevention measure.

14-48. **Apparatus and Method of Measuring Permeability in Plaster Molds.** John M. Neff. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 965-976. 14 ref.

Need for obtaining reliable data concerning the use of plaster of Paris and similar mold and core mixtures. Primary attention is given to the study of permeability and porosity and to the development of apparatus for testing permeability in plaster molds and cores.

14-49. Casting Supercharger Buckets at Allis Chalmers. G. W. Birdsall. *Steel,* v. 116, Jan. 29, '45, pp. 72-75, 96, 99-100.

Significant wartime development is perfection of the "lost wax" or investment method of precision casting and its application to the production of buckets for aircraft engine turbosuperchargers. Important postwar uses are foreseen because of ability to cast parts of intricate design to dimensional tolerances of 0.001 in. or less and with such smooth surfaces as to require little or no finishing. Said to do for high melting point metals and alloys what die casting does for materials in the lower melting point ranges.

14-50. Centrifugal Steel Castings. L. Northcott and D. McLean. *Metal Progress,* v. 47, Feb. '45, pp. 277, 328.

Centrifugal castings of tubular shape 6½ in. diameter and about 1¾ in. wall thickness were made of a nickel-chromium-molybdenum steel. Rotating mold had its axis horizontal and the speed ranged, for different casts, from 450 to 1700 r.p.m. Castings were cut transversely at mid-length and three distinct types of structures observed, of the same fundamental nature as those found in similar non-ferrous castings. (Abstract of paper for Iron & Steel Institute.)

14-51. Improvements in Static Ferrous Castings Influencing Their Future Use. G. Vennerholm. *S.A.E. Journal,* v. 53, Feb. '45, pp. 103-109.

Developments and improvements relative to static ferrous castings, along with an analysis of the influence they may have on future design and manufacturing methods of the automotive, aircraft, and related industries. New steels and molding materials have been introduced, as well as improvements in melting, molding, and heat treat techniques, better methods of inspection, and greater uniformity of product.

14-52. Refractory Molds for Precision Casting. Jules W. Glaser. *Iron Age,* v. 155, Feb. 8, '45, pp. 52-57.

The refractory mold as the critical feature in the process; data on the binder used for high temperature investments.

14-53. Casts Miles of Steel Chain. Pat Dwyer. *Foundry,* v. 73, Feb. '45, pp. 74-77, 220, 222.

New method and equipment for casting steel chains in the foundry.

14-54. Foundry Progress in 1944. *Foundry,* v. 73, Feb. '45, pp. 78-79, 178.

Principal developments during 1944 in foundry processes and products are cited by industry authorities, as taken from a general review of the metal working industries as presented in the Jan. 3 issue of *Steel.* Gray Iron Industry Improves Product Quality by Better Control, by R. G. McElwee; Water Quenching of Steel Castings Extended to Many Types, by Charles W. Briggs; Non-Ferrous Foundries Making Greater Use of Mechanical Processes, by Harold J. Roast; Continuous Melting Aids Production of Malleable Iron Castings, by James H. Lansing.

14-55. **Permanent Mold Castings.** John Vickers. *Foundry,* v. 73, Feb. '45, pp. 86-87, 200, 202, 204.

Advantages of permanent mold casting: Smoother finish and closer dimensional accuracy; greater possible speed of production; conservation of raw material; reduction of production scrap; improved mechanical properties in the casting.

14-56. **Malleable Castings for Heavy Duty Trucks.** Pat Dwyer. *Foundry,* v. 73, Feb. '45, pp. 90-93, 224.

Malleable iron foundry recently erected and placed in operation by Saginaw Malleable Iron Division, General Motors Corp., at Tilton, Ill. Molding machines mounted in pits; metal superheated in electric furnace.

14-57. **The Production and Founding of Inoculated High-Duty Cast Iron.** J. L. Francis. *Foundry Trade Journal,* v. 75, Jan. 4, '45, pp. 7-10.

Cooperation of the designing, pattern-making, founding, and metallurgical departments.

14-58. **Magnesium Inhibitors and Their Relationship to Core Practice.** G. H. Curtis. *Light Metal Age,* v. 3, Jan. '45, pp. 16-21, 39-40, 46.

Discusses present practices with the volatile inhibitors and aims to advance a modified technique for foundry practice with a potassium fluoborate, and the properties of this inhibitor are compared with various other fluorides. 2 ref.

14-59. **Precision Casting.** R. Neiman. *Metal Industry,* v. 66, Jan. 5, '45, pp. 5-7.

Adaptation of investment process in commercial work; review of materials, methods and machines for the production of armament parts by the "lost wax" process. (Presented at the Third War Production Foundry Congress, American Foundrymen's Association.)

14-60. **The Use of the Blast Furnace Slag as a Core Sand.** Adolf Fisher. *Die Giesserei,* v. 31, Jan., '44, pp. 5-7.

For evaluating the possibility of using the blast furnace slag as a core sand, the chemical and physical properties of slag granulated in cold water (including the grain sizes and their type) were determined. The granulated slag was coarser than regular sands. Some very large iron castings are regularly cored with slag-sand.

14-61. **Precision Casting.** R. Neimen. *Metal Industry,* v. 66, Jan. 12, '45, pp. 20-22.

Consideration is given in this installment to the shrinkage factor of investments, to the alloys which have been cast successfully by the precision casting process and to the production of patterns.

14-62. **Practical Application and Theory of Gating and Risering Practices in Molding Non-Ferrous Castings.** A. C. Boak. *American Foundryman,* v. 7, Feb. '45, pp. 11-13.

Fundamentals of correct gating and risering so that they may be applied when casting alloys of copper,

tin, lead and zinc which naturally are prone to shrinkage. (*Canadian Metals & Metallurgical Industries,* Nov. '44.)

14-63. **Precision Casting.** R. Neimen. *Metal Industry,* v. 66, Jan. 19, '45, pp. 39-41.

Descriptions of the production of the metal die, of the mixing of the investment and of the burning out of the mold form. Two types of precision casting machines are described.

14-64. **The Production of Builders' Castings.** Charles Gillespie. *Foundry Trade Journal,* v. 75, Jan. 25, '45, pp. 65-68.

Repetition foundry and postwar demands.

14-65. **Methods and Problems Indigenous to a General Engineering Iron-Foundry.** William Montgomery and John Doig. *Foundry Trade Journal,* v. 75, Jan. 25, '45, pp. 71-74.

Jobbing shop as a training ground for molders.

14-66. **Precision Casting.** R. Neiman. *Metal Industry,* v. 66, Jan. 26, '45, pp. 59-60.

Concluding review of the precision casting process; deals with the fields of application for the process and with the importance of efficient laboratory control.

14-67. **Baked Magnesium Sand Molds Inhibited With Potassium Fluoborate.** G. H. Curtis. *Iron Age,* v. 155, Feb. 22, '45, pp. 54-61.

Potassium fluoborate used as a magnesium oxidation inhibitor in molding sands for the first time on a large scale. Properties of the fluoborate, in regard to baking characteristics, shake out and collapsibility of the molds, are more favorable than those obtained with the use of boric acid. The fact that this inhibitor decomposes at relatively high temperatures allows greater latitude in core baking practice. It may be used as a sand addition agent, thus eliminating spraying and drying operations. 3 ref.

14-68. **Methods and Problems Indigenous to a General Engineering Iron Foundry.** William Montgomery and John Doig. *Foundry Trade Journal,* v. 75, Jan. 11, '45, pp. 25-29, 33.

The jobbing shop as a training ground for molders.

14-69. **Casting Cutting Tools From High Speed Steel Scrap.** J. Albin. *Iron Age,* v. 155, March 1, '45, pp. 54-57.

In a Ford sponsored project set up to take care of disabled veterans, small high speed steel cutting tools are being cast to shape by the "lost wax" refractory mold process, with a few production refinements added.

14-70. **Patternmaking.** W. C. Perry. *Foundry Trade Journal,* v. 75, Feb. 1, '45, pp. 85-90.

Modern patterns require the skill of the finest woodworker.

14-71. **Effect of Shrinkage and Gas Porosity on the Pressure Tightness and Mechanical Properties of Bronze Sand Castings.** *Foundry Trade Journal,* v. 75, Feb. 1, '45, pp. 91-93.

Eliminating wasteful practice of pre-ingotting bronzes made from virgin metals.

14-72. **Producing Non-Ferrous Castings.** R. MacLuckie. *Canadian Metals & Metallurgical Industries,* v. 8, Feb. '45, pp. 28-31.

Practical considerations in equipment and technique.

14-73. **Prospects for Cast Metals.** Donald J. Reese. *Canadian Metals & Metallurgical Industries,* v. 8, Feb. '45, pp. 38-40.

Brings together some of the essential points that should form the basis of any educational program with considerable detail on gray iron. (Presented at the War Production and Future Planning Conference of the Engineering Societies on War Production, in New York City, Jan. 30, '45.)

14-74. **Research Methods in Cast Iron Metallurgy.** J. E. Hurst. *Metal Treatment,* v. 11, Winter '44-'45, pp. 219-228.

Investigation on castings continuously produced under uniform methods, where some of the castings showed porosity while others were perfectly sound.

14-75. **Precision Casting by the Lost-Wax Process.** Adam Dunlop. *Metal Treatment,* v. 11, Winter '44-'45, pp. 247-258.

Outlines a process by which castings in a wide range of alloys can be produced, of such dimensional accuracy and excellence of "as cast" surface finish that little machining is required even for engineering components requiring a high degree of precision. By this process it is possible to produce small castings in steel, high nickel alloys, bronze and brass, etc., to within ±0.002 per in. This precision casting is a modern development of the old lost-wax process. 7 ref.

14-76. **Die Castability of Metals and Alloys.** *Light Metal Age,* v. 3, Feb. '45, pp. 14-16, 37.

Integrates and discusses the individual metallurgical characteristics which account for the final behavior of light alloys in the die casting machine.

14-77. **British Foundrymen Investigate Basic Cupola Operation to Reduce Sulphur and Phosphorus.** *American Foundryman,* v. 7, March '45, pp. 6-10.

Examination of results obtained in practice with basic-lined cupolas. (Reprinted from *Foundry Trade Journal.)*

14-78. **Veterans Learn to Make Precision Castings.** *Foundry,* v. 73, March '45, pp. 84-85, 206.

Using methods developed by Ford technicians, operations are carried on in a small pilot plant at Camp Legion—Henry Ford's rehabilitation camp for handicapped veterans of World War II.

14-79. **Weighing Cupola Fuel and Metal Charges.** Donald J. Reese. *Foundry,* v. 73, March '45, pp. 86-87, 190, 192, 194.

Reasons given why cupola charge materials are weighed. Cupola charges smaller; carbon variance; use different scales; scale must be strong.

14-80. **Progress in Malleable Iron Melting in the United States.** A. J. Grindle. *Foundry,* v. 73, March '45, pp. 91, 196, 198.

Melting methods and fuels utilized; grades of malleable iron produced; analysis changes in duplexing.

14-81. **Permanent Mold Castings.** John Vickers. *Foundry,* v. 73, March '45, pp. 100-102, 200, 202, 204.

Molds and procedures in casting with permanent molds.

14-82. **Oxidation Inhibitors in Core-Sand Mixtures for Magnesium Castings.** O. Jay Myers. *Metals Technology,* v. 12, Feb. '45, T.P. 1776, 9 pp.

Basic core of dry-sand mold mixture for magnesium in use today is compounded with sand, core oil or resin binder, cereal, and moisture. Core oil or resin binder are added for baked strength while the cereal binder and moisture are for green strength. Protective agents; experiments with mixtures; physical properties of core-sand mixtures.

14-83. **Symposium on Continuous Casting.** *Metals Technology,* v. 12, Feb. '45, T.P. 1793, 46 pp.

Opening remarks by Carl E. Swartz. Continuous Casting Yesterday and Today, by T. W. Lippert. Continuous Casting of Metals—History. Requirements, Metallurgy, and Economics, by Norman P. Goss. Improvements in the Direct Casting of Strip Metals; by C. W. Hazelett. The Soro Process, by E. I. Valyi. The Williams Process of Casting Metals, by E. R. Williams.

14-84. **The Principles of the Testing of Mould and Core Sands and Their Development Possibilities With Special Reference to the Fischer Testing Apparatus.** W. Goetz. *Giesserei,* v. 30, June '44, pp. 91-95. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 75-A.

Having regard to the advancement in the knowledge of the properties and characteristics of molding sands, improvements in sand testing apparatus have been introduced. The fundamentals of sand testing are considered and some recent improvements which have been developed by a German firm making test apparatus are described.

14-85. **The Investigation of Dried Moulding Sands.** H. Baresch. *Giesserei,* v. 30, April '44, pp. 55-59. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 75-A.

Methods of testing dried molding sand for steel castings are discussed. From tests it was observed that when a green sand had a maximum permeability with 3% of moisture, dry sand of the same type had a maximum permeability when the initial moisture content was 4%. Curves showing the effect of initial moisture content on the strength and permeability of a number of sands are presented.

14-86. **New Knowledge and Proposals on the Subject of Testing Molding Sand.** W. Reitmeister. *Giesserei,* v. 31, Sept. '44, pp. 136-141. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 75-A.

Factors affecting the apparent density of molding sand mixtures are discussed and data are presented relating this property to the strength and permeability.

14-87. **A New Moulding Process for Grey Iron Castings.** K. Grunke. *Giesserei,* v. 31, Aug. '44, pp. 126-128. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 75-A.

The Godel cement-sand molding process is briefly described. In this, a cement-sand is used as pattern sand, and the remainder of the mold is filled up with silver sand. No hand or pneumatic ramming is necessary. Examples of two large castings, the molds for which were prepared in this way, are described and illustrated.

14-88. **Segregation in Babbitt.** T. E. Eagan and W. R. McCrackin. *Metal Industry,* v. 66, Feb. 23, '45, pp. 118-120.

Deals with the effect of inoculants, static and centrifugal casting methods and outlines the technique for the control of segregation in centrifugally cast bearings.

14-89. **Advantages and Characteristics of Light-Metal Permanent-Mold Castings.** L. F. Swoboda. *Machinery,* v. 51, March '45, pp. 174-176.

Difference between permanent mold casting and die casting; advantages of permanent mold castings; cost considerations in connection with permanent mold castings; the design of permanent mold castings; important points to consider in casting design; uniformity and thickness of metal section. (Presented before a recent meeting of the Society of Automotive Engineers.)

14-90. **Inoculants in Gray Iron.** Rebecca Hall Smith. *Iron Age,* v. 155, March 15, '45, pp. 58-62.

Shows how the use of inoculants aids both large and small foundries in obtaining better castings, either by the control of graphite or as stabilizers and strengtheners. Tests are described which help in the selection of the type of inoculant and the amount to use. 5 ref.

14-91. **The Relationship Between Blast Pressure, Blast Quantity and Cupola Dimensions.** H. Jungbluth. *Archiv fur das Eisenhuttenwesen,* v. 17, July-August, '43, pp. 1-4. British Cast Iron Research Association *Bulletin and Foundry Abstracts,* v. 7, Jan. '45, p. 217.

Experiments are described which enabled curves to be constructed showing the relationship between the pressure and volume of the blast supplied to cupolas. From these and other test results a formula was derived for the blast pressure in terms of the blast volume, cupola cross-sectional area, cupola height and coke lump size. (Abstract reprinted from Iron and Steel Institute *Bulletin,* no. 105, Sept. '44, pp. 121A-122A.)

14-92. **Precision Casting Obviates Machining.** Arnold Ristow. *Machine Design,* v. 17, March '45, p. 150.

Bucket patterns are molded in groups of four, with individual riser and a common branch riser molded in-

tegral. Molding is done in bismuth-lead die sets made from a steel "master" machined to the exact shape of the bucket plus shrinkage allowance. Wax at a temperature of 140° F. is injected into the mold under a pressure of 65 to 85 psi.

14-93. **Stronger Die Castings Are Obtained by Proper Die Design.** *Steel,* v. 116, March 26, '45, pp. 94-95, 128, 130.

Method of establishing values of impact strength, tensile strength, elongation and other mechanical properties of zinc alloys for die casting is to use data obtained from die cast test bars made under controlled conditions representative of what is considered best practice. Investigation showed that the design of the die has an appreciable effect on the properties of the casting made in it.

14-94. **Founding of Magnesium Alloys.** *Light Metals,* v. 8, Jan. '45, pp. 3-6.

Fluxes, fluxing technique, and superheating.

14-95. **Precision Castings by the Lost Wax Process.** Adam Dumlop. *Foundry Trade Journal,* v. 75, Feb. 8, '45, pp. 107-116, 118.

Modern development of an old process. 7 ref.

14-96. **The Hows and Whys of Centrifugal Casting.** Harold B. Zuehlke. *Aluminum and the Non-Ferrous Review,* v. 9, July-Sept. '44, pp. 44, 46-48.

Description of process; speed of rotation; angle of shafts and pouring spouts.

14-97. **Founding of Magnesium Alloys.** *Light Metals,* v. 8, Feb. '45, pp. 82-84.

Properties of molding sands suitable for the magnesium foundry together with the nature and purpose of inhibitors.

14-98. **Work on the Spindle.** J. H. List. *Iron and Steel,* v. 18, Feb. '45, pp. 51-52.

Balanced flywheel molded in green sand.

14-99. **Magnesium Alloy Castings.** G. L. White. *Canadian Metals & Metallurgical Industries,* v. 8, March '45, pp. 20-22, 46.

Efficient production by small Canadian foundry.

14-100. **Metallurgy in the Non-ferrous Foundry.** A. C. Boak. *Canadian Metals & Metallurgical Industries,* v. 8, March '45, pp. 23-26.

Casting the high shrinkage metals and alloys. 2 ref.

14-101. **Testing Castings.** *Canadian Metals & Metallurgical Industries,* v. 8, March '45, pp. 31-36.

Modern methods aid foundry in controlling quality.

14-102. **Planning the Foundry of Tomorrow.** John E. Linabury. *Foundry,* v. 73, April '45, pp. 98-99, 230, 232, 234-235.

Ideal layout for a production-type gray iron foundry. Many of the recommendations are applicable to other types of foundries.

14-103. Centrifugal Casting Speeds. J. E. Hurst. *Foundry,* v. 73, April '45, pp. 105-106, 210, 212, 214, 216.

Early developments in centrifugal castings and theoretical calculations of rotational speed. 12 ref.

14-104. Improves Aluminum Alloy Melting Procedure. Ira M. Wise. *Foundry,* v. 73, April '45, pp. 116-119, 238, 240.

Some of the technical problems encountered in making castings from "Y" alloys for an intricate oil pump body for one of the highly specialized aircraft engines.

14-105. Rolls-Royce Cylinder Blocks. *Machinery* (London), v. 66, Feb. 22, '45, pp. 193-198.

Casting practice at Buick's aluminum factory. Outstanding feature is the extensive employment of mechanized equipment for the movement of raw materials and work in process.

14-106. The Development of Grey Iron Die Castings. H. K. Barton. *Machinery* (London), v. 66, Feb. 22, '45, pp. 213-216.

Metal molds; pressed-steel die cavities; open-mold die casting; melting technique; the Holley process; operating the Holley machine; air-cooled dies; dressing the dies; increased production.

14-107. Increasing Foundry Efficiency. Daniel W. Moll. *Aluminum and Magnesium,* v. 1, Jan. '45, pp. 16-19.

Molding; core making; sand conditioning and handling; cleaning; who should maintain pattern? Should foundry provide stock cores; keeping manufacturing department advised; development procedure; heat treating.

14-108. Engineering and Application of Magnesium Alloy Castings, II. David Basch. *Aluminum and Magnesium,* v. 1, Jan. '45, pp. 22-23, 26-30.

Welding; impregnation; casting methods; tempers of castings; choice of alloys; sand castings; general data pertaining to magnesium alloy sand castings; magnesium alloy permanent mold castings; magnesium alloy die castings. 5 ref.

14-109. Fourth Progress Report on Investigation of Physical Properties of Steel Foundry Sands at Elevated Temperatures. D. C. Williams. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 979-1009.

An investigation of the size of the posts and the material from which they were made, of air drafts through the heating unit, improved positioning of test specimen within the furnace, refinements in testing technique. 35 ref.

14-110. Mold Atmosphere Control. H. W. Dietert, R. L. Doelmann and R. W. Bennett. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1053-1077.

By incorporating mold atmosphere control so that the gases in the mold are not oxidizing, much of the work now being done in the cleaning room possibly may be eliminated, with a saving in labor, equipment, and compressed air cost.

14-111. **A Study of Molding Methods for Sound Castings.** F. G. Sefing. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1126-1136.

Principles involved in making castings sound. 6 ref.

14-112. **Considerations in Casting and Coining Malleable Iron.** H. W. Streeter. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1146-1150.

Coining to produce malleable iron castings having a dimensional accuracy equal to that of machined surfaces. The data are insufficient to warrant drawing many conclusions.

14-113. **Some Causes of Test Bar Failures in Navy "G" and "M" Metals.** Wm. B. George. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1175-1188.

When a test bar fails, the foundryman is often unable to diagnose the trouble and prevent it from happening. If the first test bar fails and the second bar passes, the foundryman does not investigate further. There is a reason why one of these bars failed. This paper is prepared for those who are interested in these failures and represents actual cases.

14-114. **Studies on Bore Cracks in Flanged Fittings.** Joseph A. Duma and Stanley W. Brinson. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1217-1250.

Effect of various molding, thermal, and design factors on the formation of the widely publicized bore cracks in flanged castings. Influences which tend both to suppress and to accentuate bore cracking are listed. Several methods of dealing with these cracks discussed. Probable mechanism of bore-crack formation described.

14-115. **Design of Test Coupons for Cast Steel.** R. C. Wayne, H. F. Bishop and H. F. Taylor. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1251-1265.

Test coupons of various designs were cast in steel, and their relative merits in producing satisfactory blanks for tensile tests compared on the basis of mechanical properties and economy of yield. Coupons of the cloverleaf type in which the tensile blanks are spaced around a central section not only give properties equal to or better than those of other more conventional types, but require much less riser metal per specimen. The blanks may be readily removed by a cold saw or torch. 3 ref.

14-116. **Gray Iron—Steel Plus Graphite.** J. T. MacKenzie. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1266-1270.

Formation of graphite. (Reprinted from the Twenty-first Annual Henry Marion Howe Memorial Lecture, published in *Metals Technology,* June '44.)

14-117. **The Use of Gypsum Cements in Pattern and Model Making.** E. H. Schleede. American Foundrymen's Association *Transactions,* v. 52, June '45, pp. 1271-1285.

Characteristics of gypsum cement and how it may be used in making patterns and models. Necessary tools and equipment and five different work methods described. Figures used to show some of the characteristics of the material and techniques employed.

14-118. **Drying and Preheating of Foundry Ladles.** C. E. Bales and F. McCarthy. American Foundrymen's Association *Transactions*, v. 52, June '45, pp. 1286-1292.

Effect of boiling; behavior of damp linings; ladle lining materials; vent holes in ladles; methods for drying ladles; methods for preheating ladles.

14-119. **Thermosetting Plastic Core Binders for Ferrous and Non-Ferrous Metals.** William C. Morgan. American Foundrymen's Association *Transactions*, v. 52, June '45, pp. 1317-1324.

Types of thermosetting plastic core binders and their related factors in ferrous and non-ferrous metals; the relation of these binders to casting quality and the characteristics of the binders in reaction with sand and ingredients in the core sand formula. Workability in the core room, including baking, collapsibility, gas and retained strength of the core. Procedure and results of experiment conducted to determine requirements of such binders in several foundries. 4 ref.

14-120. **The War-Time Aluminum Foundry.** George Mortimer. *Metallurgia*, v. 31, Feb. '45, pp. 187-192, 196.

As aluminum became commercially available and was applied to engineering, it soon became evident that it was too soft for many engineering purposes and aluminum alloys began to appear. Initially these were used for castings and although development was slow in applying these new alloys, the motor car and, more recently, the airplane have given a tremendous impetus to development.

14-121 **Progress in Aluminum Die-Casting.** Arthur Street. *Metallurgia*, v. 31, Feb. '45, pp. 197-200.

Aluminum alloy die castings combine the accuracy, uniformity, and superior surface finish of die castings in general with the lightness, strength, and high degree of resistance to corrosion of the aluminum alloys. Review indicates the high standard of modern production technique and provides useful guidance to industries seeking effective methods of production of non-ferrous components.

14-122. **First Report of the Foundry Practice Sub-Committee of The Steel Castings Research Committee.** Iron and Steel Institute, Advance Copy, Feb. '45, 53 pp.

Part 1 records work on the running and risering of simple shapes used as 4-in., 6-in. and 9-in. cube castings, and castings 6 in. square by 12 in., 18 in. and 24 in. long. Part 2 discusses the so-called "whirl-gate" head method of feeding steel castings and recent examples of the application of this type of head and of the "atmospheric" head. Foundry trials comparing the different types of feeding compound used on the fluid steel as it rises into the heads of steel castings are sum-

marized in part 3. Part 4 gives experiments designed to provide a numerical index of the tendency of different steels to hot tears in the mold. In Part 5, some of the wartime activities of the sub-committee are set out, and some fundamental casting problems are mentioned in Part 6.

14-123. **Copper Castings.** J. B. McIntyre. *Metal Industry,* v. 66, March 23, '45, pp. 178-179.

Difficulties encountered when casting "pure" copper have been attributed to the presence of oxygen. Author analyses the causes of porosity and suggests a procedure to reduce troubles to a minimum. 2 ref.

14-124. **Gating, Risering and Chilling of Magnesium Castings.** A Cristello. *American Foundryman,* v. 7, April '45,

Standardized gating and risering. Maintain control and troubles will be minimized. (Originally delivered as a technical paper at a W.P.B. meeting.)

14-125. **Influence of Centrifugal Casting Upon Steel.** L. Northcott and D. McLean. *Engineering,* v. 159, March 9, '45, pp. 197-200.

Determines the influence of variations in casting temperature, mold speed, mold temperature and rate of pouring upon the structure, segregation and properties of centrifugally cast thick cylinders with any one alloy composition. (Iron and Steel Institute.)

14-126. **Some High-Tensile Aluminum Casting Alloys.** J. Morgan. *Foundry Trade Journal,* v. 75, March 8, '45, pp. 189-194.

Addition of silicon to aluminum improves its properties for casting purposes, raises the strength without rendering the alloys brittle and decreases the density. Aluminum-silicon alloys are exceptionally fluid and give sharper impressions of intricate molds than almost any other aluminum alloy. When melted and cast in the normal manner, the alloys exhibit no outstanding properties, but, if subjected to the process of modification, the structure of the alloys undergoes a change and a beneficial effect on the properties is produced.

14-127. **A Mechanized Foundry.** *Automobile Engineer,* v. 35, March '45, pp. 87-94.

Mechanization of the Humber Ltd. Foundry whereby a 250% increase in production capacity has been obtained from the same superficial area, with an increase of less than 100% in the labor employed. Description is given of a special fixture used for assembling cylinder block cores ready for insertion in the mold. Reference is made to the methods employed for controlling material quantity and for testing the finished castings.

14-128. **Ford Produces High-Speed Steel Cutters by Precision Casting.** Charles O. Herb. *Machinery,* v. 51, April '45, pp. 144-151.

Unusual application of the waste wax or investment method of mold making which has enabled large economies to be effected and which points the way to many postwar applications.

14-129. **An Important Message Via Teletype.** R. R. Teichner. *Die Casting,* v. 3, April '45, pp. 22-25, 48, 50.

Parts formerly machined from bar stock or from rough sand castings and which are now die cast to tolerances ranging from 0.0005 to 0.005 in.

14-130. **Design Rules—XII.** Herbert Chase. *Die Casting,* v. 3, April '45, pp. 28, 30-32.

Do make use of letters, numerals and other markings wherever they add to the utility of the die casting without unjustified cost, but make sure that details do not incur needless expense in preparing the die or interfere with ejection of the casting.

14-131. **Steel Foundry Practice.** *Engineering,* v. 159, March 16, '45, p. 206.

Degree of hot tearing on a particular design can be minimized, or often eliminated, by using steel with a lower sulphur content. With normal designs, there should be little trouble if the sulphur content is below 0.035% but for more intricate designs it may be necessary to go to still lower limits.

14-132. **A Foundryman's Notebook.** *Iron and Steel,* v. 18, March '45, p. 81.

Positioning and securing cores.

14-133. **The Hows and Whys of Centrifugal Casting.** Harold B. Zuehlke. *Aluminum and the Non-Ferrous Review,* v. 9, Oct.-Dec. '44, pp. 60, 62-63.

Advantages and disadvantages of graphite molds; mold draft; mold wall protection; measuring metal poured; condition of metal at time of pouring; special procedure for larger castings; advantages.

14-134. **Prospects for Principal Cast Metals.** Donald J. Reese. *Tool & Die Journal,* v. 11, April '45, pp. 102-104.

Why the foundry process of manufacture is of value to the engineer in his efforts to build better machines.

14-135. **Metallurgy of Die Casting.** J. L. Erickson. *Metal Industry,* v. 66, April 6, '45, pp. 217-218, 220.

Die casting is more of an art than a science, and will remain so until the fundamental metallurgy of the process receives more consideration. (From *The Foundry.*)

14-136. **Casting Short-Run Variable Designs.** J. N. McLaughlin. *Iron Age,* v. 155, April 19, '45, pp. 67-70.

Method devised with the object of obtaining the advantages related to match-plate production without incurring the full costs which would normally accrue from standard match-plate use.

14-137. **Distinctive Features of Sterling Permanent Molds for Aluminum Piston Castings.** Joseph Geschelin. *Automotive Industries,* v. 92, April 15, '45, pp. 30-32, 68, 70.

Patented permanent mold equipment is said to produce pistons of unusual quality, featuring density of structure, freedom from porosity, fidelity of dimensional tolerances, and exceptionally fine finish of the cavity.

14-138. **Die Casting Grey Iron in a British Foundry.** *Machinery* (London), v. 66, March 29, '45, pp. 333-339.

The siphon-brick method; continuous rotary-die casting machine; sand cast dies.

14-139. **Metallurgical Aspects of Machine-Tool Castings.** J. G. Ritchie. *Foundry Trade Journal,* v. 75, March 22, '45, pp. 231-234.

Meeting the requirements of the engineer. Effect of section, total carbon and silicon; melting practice; damping capacity.

14-140. **Steel Foundry Practice.** *Metallurgia,* v. 31, March '45, pp. 253-256.

Report divided into six parts which include the feeding of simple castings; the "whirl-gate" head and the "atmospheric" head feeding compounds; hot tears; wartime activities; and fundamental casting problems to be considered. (Iron & Steel Institute, Feb. '45.)

14-141. **Centrifugal Casting of Steel.** C. K. Donoho. *Western Metals,* v. 3, April '45, pp. 10-14.

Elongation; types of centrifugal casting; molds; axes; spinning speeds; typical castings; structure and properties; quality considerations. 8 ref.

14-142. **Permanent Mold Castings.** Alfred Sugar. *Metals & Alloys,* v. 21, April '45, pp. 1015-1028.

Points out the design possibilities and limitations of permanent mold castings as well as the many pitfalls in the path of a permanent mold foundryman. Care and practice have shown that all the variables in the art will lend themselves to ready control in production. 10 ref.

14-143. **Runners and Risers.** A. Roberts. *Institute of Australian Foundrymen: Australasian Engineer Science Sheet,* Dec. 7, '44, pp. 2-5. Iron & Steel Institute *Bulletin* no. 111, March '45, p. 123-A.

Recommendations are made on the dimensions of sprues, runners, gates, and risers and on their best positions relative to the casting.

14-144. **Molding Sands of South Australia.** H. A. Stephens. *Australian Institute of Metals: Australasian Engineer Science Sheet,* Nov. 7, '44, pp. 22-29. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 123-A.

Various features of South Australian molding sands and molding practice are discussed. South Australian molding sands are found to be poor, but molding practice can be improved by the wider use of synthetic sands and by increased attention to the preparation of the sand.

14-145. **The Influence of Various Metallurgical Factors on Ingot-Mold Life.** B. Koros. Iron and Steel Institute Translation Series, no. 211, 1945. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 125-A.

An English translation of a paper which appeared in *Stahl und Eisen,* v. 64, March 9, '44, pp. 159-164. (See Iron and Steel Institute *Journal,* 1944, no. II, p. 148-A.)

14-146. **The Effect of Grain Shape on the Molding Properties of Synthetic Molding Sands.** W. Davies and W. J. Rees. *Refractories Journal,* v. 21, March '45, pp. 98-118.

14-147. **Effect of Gas on the Properties of Magnesium Sand Casting Alloys.** R. S. Busk and R. F. Marande. *American Foundryman,* v. 7, May '45, pp. 34-44.

Investigation has shown that gas will produce an appearance substantially the same as microshrinkage. Severity of microporosity is proportional to exposure to moisture. Methods of removing the effects of gases, and particularly hydrogen, in metals by lowering the partial pressure and introducing an agent that reacts with the hydrogen in such a way as to remove it. 7 ref.

14-148. **Effect of Composition on Mechanical Properties of Sand Cast Copper-Tin-Lead-Zinc Alloys.** W. T. Battis. *American Foundryman,* v. 7, May '45, pp. 45-48.

Mechanical property determinations on a series of sand-cast copper-base alloys; calculated effects of composition changes, presented graphically and in tabular form. 3 ref.

14-149. **The Postwar Outlook for the Foundry Industry.** E. F. Platt. *American Foundryman,* v. 7, May '45, pp. 66-67.

Emphasizes the need for intelligent cooperation within the industry to meet the problems of postwar competition.

14-150. **Founding of Magnesium Alloys.** *Light Metals,* v. 8, April '45, pp. 171-172.

Principles of ultra-light alloy casting summarized, and the need for assessing each individual case on its own merits stressed.

14-151. **Pressure Die Casting.** J. L. Erickson. *Light Metals,* v. 8, April '45, pp. 173-189.

Effect exerted by air trapped in the die cavity on the physical properties of certain die-casting alloys and on their heat treatability. Design of a special die constructed to investigate the effects.

14-152. **Advantages of Ingot Metal.** George F. Beard. *Canadian Metals & Metallurgical Industries,* v. 8, April '45, pp. 28-32.

Modern refining facilities and laboratory control aid foundry industry. Ingot vs. scrap; impurities in copper alloys; aluminum and its alloys; metallic impurities in aluminum; laboratory control.

14-153. **Gating. Risering, and Chilling of Magnesium Sand Castings.** A. Cristello. *Foundry,* v. 73, May '45, pp. 94-95, 254.

Information, sketches and outlines delivered at a War Production Board meeting of Magnesium Sand Casting Section, Cleveland, Nov. 29-30, 1943.

14-154. **Centrifugal Casting Speeds.** J. E. Hurst. *Foundry,* v. 73, May '45, pp. 100, 128, 220, 222, 224, 226.

Centrifugal casting speeds employed in commercial practice. 22 ref.

14-155. **Plant Modernization Increases Malleable Production.** William G. Gude. *Foundry,* v. 73, May '45, pp. 102-105, 230, 232.

Belle City Malleable Iron Co., Racine, Wisconsin, revamped a large part of its foundry to incorporate duplex melting facilities, mold conveyors and mechanical sand handling equipment.

14-156. **High Reproducibility in Precision Casting.** W. A. Morey. *Iron Age,* v. 155, May 10, '45, pp. 75-77.

Many steps in the process lend themselves to rigorous scientific control. Future possibilities appraised. (Presented before the foundry panel, Chicago War Production Conference, March 29.)

14-157. **Die Casting Precision Parts.** S. U. Siena. *Steel,* v. 116, May 14, '45, pp. 108-111, 146, 148, 152, 154.

Millions of parts for instruments by slow-squeeze method of cold chamber injection. Tolerances on some parts held within 0.001 in. and comparatively little machining is required.

14-158. **The Centrifugal Casting of Aluminum Alloy Wheels in Sand Molds.** L. Northcott and O. R. J. Lee. Institute of Metals *Journal,* v. 71, March '45, pp. 93-130.

Wheels centrifugally cast in sand molds rotated on a vertical axis, using four aluminum-rich alloys: DTD 304, 2L33, DTD 300, and RR 50. In centrifugal casting of spoked wheels, porosity tends to be concentrated at the junctions of the arms with the rim and cannot be eliminated by increasing the speed of rotation unless the cross-sections of the arms are larger than in normal practice for static castings. Mechanical properties of samples from three positions in each casting were determined. Although there was only a slight increase in density, test bars from centrifugal castings in DTD 304 showed an improvement of 15% in tensile strength and 78% in elongation over a static casting. Macrostructure of the centrifugal castings showed columnar crystals growing from inner vertical surfaces, with equi-axial crystals in the outer zones of the castings. As the speed of rotation increased, the columnar crystals became longer and the equi-axial crystals smaller. Additional castings in other selected alloys provided data which confirmed an explanation of the origin of the structures based on the operation of a centrifuging action during the solidification interval, when the densities of liquid and solid are different. 26 ref.

14-159. **Making Die Castings.** H. E. Nagle. *Steel,* v. 116, April 23, '45, pp. 92-96, 138.

Details of intricate die design and production methods in Yale & Towne's Stamford plant.

14-160. **First Report of the Foundry Practice Sub-Committee of The Steel Castings Research Committee.** Iron & Steel Institute, Advance copy, Feb. '45, 53 pp.

Part 1, work on the running and risering of simple shapes. Developing the so-called "whirl-gate" head method of feeding steel castings and recent examples of the application of this type of head and of the "at-

mospheric" head described and illustrated in Part 2. Foundry trials comparing the different types of feeding compound used on the fluid steel as it rises into the heads of steel castings summarized in Part 3. Part 4, experiments designed to provide a numerical index of the tendency of different steels to hot tears in the mold. In part 5 some of the wartime activities of the sub-committee are set out, and some fundamental casting problems are mentioned in Part 6.

14-161. **Core Making.** *Steel,* v. 116, April 30, '45, p. 116.
Speeded up by conveyor ovens which cut much handling work, produce cores with greater impact and tensile strength, make 32% saving over previous methods, handle 7500 lb. of cores.

14-162. **Melting and Casting.** *Metals & Alloys,* v. 21, April '45, pp. 1072, 1074, 1076, 1078.
Melting, alloying, refining and casting methods, furnaces and machines. Iron and steel making, non-ferrous metal production, foundry practice and equipment. Die casting, permanent mold casting, precision casting, etc. Refractories, control equipment and accessories for melting furnaces.

14-163. **Little Recognized Factors Influencing the Quality of Aluminum Pressure Die Cast Parts.** James L. Erickson. *Aluminum & Magnesium,* v. 1, May '45, pp. 16-19, 30-32.
Chemical composition and cleanliness of the ingot metal; size and weight of the ingots; holding furnace; crucible or pot material and pot wash; thermo-control system; absorption of gases and the consequences; flux; temperature of retention of the molten metal; time of retention of the metal; turbulence in the melt.

14-164. **Malleabilization of White Cast Iron.** E. E. Howe. *Better Enameling,* v. 16, May '45, pp. 6-8.
Satisfactory malleable casting can be obtained from white cast iron by holding at 1650° F. for 15 hr., cooling rapidly to 1250° F. and holding for 20 hr., followed by air cooling to room temperature. The resulting material may be considered a spheroidized pearlitic malleable cast iron, which has comparable ductility to that of a true malleable.

14-165. **A New Automatic Casting Machine for the Production of Metal Ingots and Blooms.** Kurt Hoffmann. *Zeitschrift für Metallkunde,* v. 26, Feb. '44, pp. 46-48.

14-166. **Quality Control in Die Casting.** *Production and Engineering Bulletin,* v. 4, April '45, pp. 129-132.
Statistical methods of control are not limited to controlling the quality of work produced on machine tools, but also provide a useful check on the soundness of die castings and assist in maintaining quality at a high level.

14-167. **Vacuum Casting of Electronic Parts.** Kenneth Rose. *Metals and Alloys,* v. 21, May '45, pp. 1324-1326.
Vacuum melting and casting of metal parts that must be highly pure or gas-free, such as the copper

anodes for X-ray tubes whose manufacture (using induction heating) is described.

14-168. **The Basic Principles in the Feeding of Castings.** J. G. Nisbet. *Foundry Trade Journal,* v. 75, April 12, '45, pp. 293-297; April 19, '45, pp. 319-322.

Standard methods of running compared with the author's preferences.

14-169. **The Manufacture of Special Heat-Resisting Cast-Iron Retorts.** F. J. Bullock. *Foundry Trade Journal,* v. 75, April 19, '45, pp. 323-325.

Testing; making of the pattern; core iron; molding on end; mold pressure; molding on side; assessing the blame; horseshoe nails; question of design.

14-170. **Casting Tool Steels Centrifugally.** *Steel,* v. 116, June 4, '45, p. 112.

Using an indirect arc, rocking melting furnace the tools are cast centrifugally in molds approximately to finished size. Tools retain their cutting ability on many types of work several times longer than previously had been considered possible, and cutting speeds can safely be increased by 20%.

14-171. **Magnesium Castings for Aircraft Engines.** Edwin Bremer and Huey Summers. *Foundry,* v. 73, June '45, pp. 86-89, 190, 192, 196.

Diagrammatic sketch of Wright Aeronautical Corp. production equipment arranged so that there is a steady flow of materials in various stages from one end of the plant to the other. Has well equipped pattern shop; uses electro-magnets in the interior of core patterns for holding chills and wires in place.

14-172. **Aluminum Foundry Practice.** F. D. Chew. *Foundry,* v. 73, June '45, pp. 90-91, 220, 222, 224, 226.

Points to be observed and problems to be solved in producing satisfactory aluminum castings.

14-173. **Gray Iron Castings for Power Plant Equipment.** Pat Dwyer. *Foundry,* v. 73, June '45, pp. 96-98, 216, 218.

Production of gray iron castings by the Elliott Co. Describes pattern equipment; cleaning the castings.

14-174. **Two Anomalies of Graphitization.** Lester Crome. *Foundry,* v. 73, June '45, pp. 100-101, 246, 248.

Effects of silicon and aluminum as graphitizers in the production of malleable iron for white iron castings.

14-175. **Foundry Facing Materials.** J. A. Ridderhof. *Foundry,* v. 73, June '45, pp. 102, 260, 262, 264.

Use seacoal for facing having a fineness number close to that of the sand in which it is mixed. Do not expect core and mold coatings to correct poor sand. Use additional binder and bentonite if more than 10 to 15% of other materials are added. Standardize solution Baumés and control all mixes with a hydrometer. Use care in torch drying molds to prevent burning the binder out of the coating.

14-176. **Let's Have More Research.** Edwin Bremer. *Foundry,* v. 73, June '45, pp. 103, 232, 234.

Research in foundry products and foundry practices must keep pace with developments in other industries if castings are to maintain or improve their competitive position among engineering materials.

14-177. **Microporosity in Magnesium Alloy Castings.** W. A. Baker. Institute of Metals *Journal*, v. 71, April '45, pp. 165-204.

Causes of porosity in sand blasting studied, and a theory advanced to account for its formation and characteristic features. Porosity is due to freezing shrinkage and dissolved hydrogen may aggravate the trouble; the sources of contamination and methods for the removal of dissolved gas discussed. The defect is overcome in practice by careful attention to casting technique, and evidence presented to illustrate the importance of some of the factors involved. 7 ref.

14-178. **Continuous Casting.** L. H. Day. *Metal Treatment*, v. 12, Spring '45, pp. 43-48.

Principles of various machines in current use, and shows how they are applicable to the continuous casting of ferrous and non-ferrous tubes.

14-179. **Elimination of Cracks in Magnesium Pressure Die Castings.** *Light Metal Age*, v. 3, May '45, pp. 14-16.

Study of the procedure used to determine causes of the cracking in magnesium pressure die cast parts, together with recommendations and discussion towards correcting the condition.

14-180. **Technical Control in the Jobbing Foundry.** R. D. Cheyne. *Foundry Trade Journal*, v. 76, May 17, '45, pp. 47-50.

Influence of one variable factor upon another; role of the patternshop; oil sands; hydraulic spindle casting; valve block casting.

14-181. **Metallurgy in the Non-Ferrous Foundry, VIII.** A. C. Boak. *Canadian Metals and Metallurgical Industries*, v. 8, May '45, pp. 30-32.

Molding sand.

14-182. **"Whirl-Gate" and "Atmospheric" Heads.** *Canadian Metals and Metallurgical Industries*, v. 8, May '45, pp. 33-35.

Pioneer work in developing the whirl-gate head and recent applications of this type of head and of the atmospheric head.

14-183. **Die Stresses.** E. Mickel. *Metal Industry*, v. 66, May 4, '45, pp. 276-279.

Destructive effects on pressure-casting dies in operation. (Translated from *V.D.I. Zeitschrift*.)

14-184. **Solidification of Metals.** H. A. Schwartz. *American Foundryman*, v. 7, June '45, pp. 26-29.

Basic principles of metals solidification—heat transfer. Equilibrium; cooling rate; solidification structures; solubility; physical properties of materials; "diffusivity"; latent heat of fusion; coefficient of thermal expansion; metal flow; surface tension; progressive feed-

ing; application of principles; physicist in the foundry; technology vs. craftsmanship.

14-185. **Malleable Iron Control.** M. E. McKinney. *American Foundryman,* v. 7, June '45, pp. 31-37.

Control processes deal with melting the cold charge in powdered coal fired reverberatory furnaces and annealing the castings in periodic ovens. Many of the control principles discussed could be applied to other melting and annealing processes.

14-186. **Describes Improved Methods in Making Match Plates of Plaster Composition.** C. C. Brisbois. *American Foundryman,* v. 7, June '45, pp. 38-43.

Varied experiments with composition match plates and a compilation from service records embodying points of interest to every practical foundryman. Facts and figures have been set down—the methods outlined may be studied in relation to individual methods and experiments in this field. Various problems encountered—the means by which they were overcome—and the development of an entirely new technique for matchplate production are described.

14-187. **Reduction of Microporosity in Magnesium Alloy Castings.** James DeHaven, James A. Davis and L. W. Eastwood. *American Foundryman,* v. 7, June '45, pp. 44-53.

Laboratory and production foundry test results indicate that the occurrence of microporosity in magnesium alloy castings may be markedly reduced by the use of melt degassing methods described. 6 ref.

14-188. **Elevated Temperature Tests in Sand Control.** Arnold Satz. *American Foundryman,* v. 7, June '45, pp. 55-59.

Controlling sands by elevated temperature tests. Securing a good base sand and using the hot compressive strength test at 2000° F. forms the basis for the preparation and maintenance of a sand mixture suitable to any specific job. The balanced base sand is chosen from the results of "spall" tests, after which hot compressive strength values lying within a definite range are maintained in the ensuing sand mixture by means of clay manipulation. Use of this method results in reduction of scrap losses due to scabs and sand inclusions.

14-189. **Die Castings for the Perfect Blend.** Francesco Collura. *Die Casting,* v. 3, June '45, pp. 20-22, 43-44, 46, 54-55.

Appearance; strength; economy; finish.

14-190. **British Permanent Molding.** Jack W. Wheeler. *Modern Metals,* v. 1, June '45, pp. 14-17, 19.

Early development of light metal permanent mold castings in England and the more recent developments brought about by war. Production methods, specific applications and the future of permanent mold castings.

14-191. **Making Standard Cast Models in Rubber Molds.** Paul Lupke, Jr. *Mechanical Engineering,* v. 67, June '45, pp. 385-386, 397.

Objective of the present process is to produce limited numbers of more or less complex pieces, without investment in high-cost dies, without highly skilled labor, and on short notice.

14-192. **Automobile Castings.** *Iron and Steel,* v. 18, May '45, pp. 150-155.
Quantity production.

14-193. **Precision Casting of Low Alloy Steels.** Lester W. Gott. *Iron Age,* v. 155, June 21, '45 pp. 46-55.
Investment casting process as a valuable supplement to conventional machining methods for producing small mechanism parts for cannon of carbon and low alloy steels. Includes cost and dimensional tolerance data on specific components, together with metallurgical and mechanical properties.

14-194. **Quality Control in Die Casting.** *Machinery* (London), v. 66, May 31, '45, pp. 606-607.
Simple system of control which has provided a useful check on the soundness of the castings and assisted in maintaining their quality at a high level.

14-195. **The Development and Application of Pattern Equipment for the Production of a Light Alloy Casting.** F. H. Hoult. *Foundry Trade Journal,* v. 76, May 31, '45, pp. 89-95, 97.
Describes the different methods used and equipment necessary to produce varying quantities of a certain casting.

14-196. **Mold Design for Aluminum Bronze Die Castings.** R. F. Lockyer. *Foundry Trade Journal,* v. 76, May 31, '45, pp. 98-100.
Need for cooperation between the designer and the foundry. Die design; knowledge of foundry procedure; runners and risers; modulus of elasticity.

14-197. **A Departure From Standard Practice.** W. Wilson. *Foundry Trade Journal,* v. 76, May 31, '45, pp. 101-103.
Economy in ordering and storage of firebricks for small foundry.

14-198. **Cast Crankshafts.** Joseph Geschelin. *Automotive Industries,* v. 92, June 15, '45, pp. 28-30, 110, 112.
Quantity production through special techniques and rigid control at C-W-C foundry.

14-199. **Properties of a General Purpose Aluminum Sand Casting Alloy.** R. A. Quadt. *Aluminum and Magnesium,* v. 1, June '45, pp. 18-19, 22-23.
Discusses an aluminum sand casting alloy which has proven itself in commercial practice. F-430 belongs to the aluminum-copper-silicon group.

14-200. **Consistency and the Cupola.** C. A. Payne. *Foundry Trade Journal,* v. 76, June 7, '45, pp. 111-117.
An outline of factors affecting the control of cupola melting.

14-201. **Plaster, Plastics and Low Melting Point Metals in Patternmaking.** H. Plucknett. *Foundry Trade Journal,* v. 76, June 7, '45, pp. 119-123.

Decorative work and the use of plaster in the foundry.

14-202. **Magnesium Die Castings.** *Metal Industry,* v. 66, June 8, '45, p. 364.

Generous fillets, which instead of being rounded should be elliptical, help considerably in eliminating rejects due to cracking of the casting while it is being ejected from the die.

14-203. **The Reclamation of Foundry Sands. II.** F. E. Fisher and A. C. Denbreejen. *Pig Iron Rough Notes,* no. 99, Spring-Summer, '45, pp. 27-35.

Reclamation of foundry sands with particular emphasis on the hydraulic or wet system of sand reclamation.

14-204. **Plaster Mold Casting.** W. P. Brown. *Steel,* v. 117, July 2, '45, pp. 96-98, 140, 142, 145.

Affords unusual dimensional accuracy, faithful reproduction of fine details, attractive as-cast surface. Two standard bronzes, one brass and one aluminum alloy now in regular prodution.

14-205. **Development and Properties of Sandcast Aluminum Alloy Having High Strength After Aging Without Previous Heat Treatment.** Hiram Brown. *Western Metals,* v. 3, June '45, pp. 8-12, 15-16.

Development and properties of a sand-cast aluminum-base alloy containing magnesium, zinc, and small amounts of titanium and chromium. This alloy has the ability to develop high strength properties on aging without undergoing heat treatment. 9 ref.

14-206. **Precision-Cast High Speed Steel.** *Machinery* (London), v. 66, June 14, '45, pp. 641-647.

Making of high speed steel cutters by precision casting. An unusual application of an unusual method described.

14-207. **Foundry Research at the Naval Research Laboratory.** William G. Gude. *Foundry,* v. 73, July '45, pp. 84-87, 167, 171-172, 174.

Seeks to emphasize importance of the role which research has played and can continue to play in improving casting quality and foundry practice.

14-208. **Magnesium Castings for Aircraft Engines.** Edwin Bremer and Huey Summers. *Foundry,* v. 73, July '45, pp. 96-99, 224-226.

By resorting to mechanization wherever possible in the Cincinnati magnesium foundry of Wright Aeronautical Corp., employee fatigue is held to a minimum, less dependence is placed on the human element, and better uniformity is maintained in production.

14-209. **Pressure Casting Aluminum Matchplates.** J. P. Callahan. *Foundry,* v. 73, July '45, pp. 100-101, 240.

Metal patterns preferred. Ingredients for the molds consist of fibrous magnesium silicate or talc, a type of

plaster of paris known as molding or casting plaster, and water. Other materials, such as silica sand, marble dust and similar products, are considered harmful for best results and should not be used.

14-210. **Pearl Harbor Foundry Keeps Navy Ships Fighting.** E. C. Kreutzberg. *Foundry,* v. 73, July '45, pp. 104-109.

Important role of the foundry at the Pearl Harbor Navy Yard in keeping the U. S. Fleet in fighting trim.

14-211. **Control in the Gray Iron Foundry.** A. J. Edgar. *Foundry,* v. 73, July '45, pp. 88-89, 215-216, 218, 220, 222.

Importance of technical control, and difficulties encountered by the gray iron foundrymen through lack of such control.

14-212. **Symposium on Continuous Casting, Held by the American Institute of Mining and Metallurgical Engineers.** *Sheet Metal Industries,* v. 21, June '45, pp. 995-999, 1000.

Points from some of the papers and discussions; early history of process; summary of processes; Alcoa DC process; E. R. Williams process; alloy steel; requirements of continuous casting; the Goss process; improvements in the direct rolling of strip metal; lack of uniformity; casting steel.

14-213. **Future of the Light Alloy Foundry Industry.** W. C. Devereux. *Metal Industry,* v. 66, June 22, '45, pp. 387-389.

Eighth Edward Williams Memorial Lecture.

14-214. **Semi-Continuous Casting.** W. M. Doule. *Metal Industry,* v. 66, June 22, '45, pp. 390-393.

Production of light alloy ingots by direct chilling. 2 ref.

14-215. **Structure Control of Gray Cast Iron, Part I.** R. G. McElwee and Tom E. Barlow. *Vancoram Review,* v. 4, Spring, '45, pp. 6-8, 21.

Reduces structural variations; effects of inoculation; hardness and strength.

14-216. **Precision Founding.** Francis Dittmar. *Iron Age,* v. 156, July 12, '45, pp. 46-49.

Analysis of the making of a wooden "try pattern," the first step in the process of arriving at accurate master patterns by trial and error.

14-217. **When Should a Part Be Die Cast?** Herbert Chase. *Die Casting,* v. 3, July '45, pp. 21, 46-48, 50, 52.

Analysis of some of the factors which enter into making the proper choice.

14-218. **Magnesium. Part II.** Don Stewart. *Western Machinery & Steel World,* v. 36, June '45, p. 276.

Describes the foundry operation.

14-219. **Superheating in Magnesium-Base Alloys.** F. A. Fox and E. Lardner. *Engineering,* v. 159, June 1, '45, pp. 438-440.

Process of superheating is one in which casting alloy, of the magnesium-aluminum type, is heated to, and

held for some appreciable time at, a temperature exceeding 840° C. Metal is then cooled quickly to the casting temperature, which usually lies between 720° and 780° C. Effect of this exposure to a high temperature is to produce a refinement of the grain of the casting. Records and discusses various experimental results concerning phenomena associated with the superheating of magnesium-base alloys.

14-220. **Precision Founding.** Francis Dittmar. *Iron Age,* v. 156, July 19, '45, pp. 62-64, 138.

Procedure for the making of the glue mold given with detailed analysis of all the steps. With the help of the glue mold, a quantity of try patterns can be made which will be utilized to establish the exact dimensions of the master pattern.

14-221. **Making High Quality Magnesium Castings.** A. Vernon Lorch. *Metals & Alloys,* v. 21, June '45, pp. 1652-1657.

Production of high quality magnesium sand castings free from undesirable contaminations and possessing good physical properties depends on control of certain factors in melting and pouring. Results of investigation and experience.

14-222. **Molding Sand Properties at Elevated Temperatures.** L. A. Kleber and H. W. Meyer. *American Foundryman,* v. 7, July '45, pp. 26-33.

Physical properties of bonded and unbonded molding sands at elevated temperatures presented comparatively in tabular and graphic form.

14-223. **Synthetic Sand in Non-Ferrous Foundries.** N. J. Dunbeck. *American Foundryman,* v. 7, July '45, pp. 40-43.

Advantages and disadvantages of naturally bonded and synthetic sands in non-ferrous foundry practice. Use of synthetic sands results in lower sand handling costs and permits of closer sand control than is possible with naturally bonded sands

14-224. **Theories of Gray Cast Iron Inoculation.** H. W. Lownie. *American Foundryman,* v. 7, July '45, pp. 57-63.

Mechanics and theories of the gray iron inoculation process.

14-225. **Steel for Castings.** *American Foundryman,* v. 7, July '45, pp. 64-66.

Developments and trends in methods of producing steel for castings are reported. Some of the problems of current concern to steel founders—hardenability, grain size control, graphitization. 42 ref.

14-226. **Photo Position Finding.** *American Foundryman,* v. 7, July '45, pp. 67-71.

Method for accurate description and transmission of casting discrepancy information has been developed and is described. Working photographs illustrate the method.

14-227. Principles of Die Casting Magnesium Alloys. C. E. Nelson and R. C. Cornell. *American Foundryman,* v. 7, July '45, pp. 72-76.

Discussion of magnesium alloy die casting production methods; alloys used; equipment and materials; operating practice; sizes and tolerances; machining and finishing.

14-228. Consider These Factors in Designing Products for Die Casting. *Steel,* v. 117, July 23, '45, pp. 114-116, 118, 120.

Before launching plans for new products, manufacturers can take advantage of the possibilities and avoid the limitations of the die casting process by studying these fundamental data assembled by the technical staff of the New Jersey Zinc Co.

14-229. Specifications for Ampoloy Continuous Cast Rod. *Aviation,* v. 44, July '45, p. 205.

These continuous cast bronzes, adapted for use in automatic screw machines, are produced by continuous withdrawal through the bottom of a casting crucible, thence passing through a cooled die which gives required finish and accuracy.

14-230. Precision Founding. Francis Dittmar. *Iron Age,* v. 156, July 26, '45, pp. 70-73.

Preparation of the plaster from which try patterns are made in the glue mold.

14-231. Die Casting Machine Development, Past and Future. H. K. Barton. *Machinery* (London), v. 66, June 28, '45, pp. 716-719.

Suggests likely avenues along which the development of die-casting machines may be expected to proceed.

14-232. Tentative Recommended Methods for Casting Cast-Iron Test-Bars. *Foundry Trade Journal,* v. 76, June 28, '45, pp. 175-176, 180.

Report intended to give guidance and information to those in difficulty.

14-233. The Gating of a Large Magnesium Casting. Anthony Cristello. *Aluminum and Magnesium,* v. 1, July '45, pp. 18-20.

Casting produced by using a dry sand or all core mold. All the gating, risering and chilling for the casting was contained in the dry sand cores. Gating and risering casting resolved into two interrelated problems.

14-234. Consider These Factors in Designing Products for Die Casting. *Steel,* v. 117, July 30, '45, pp. 104, 106, 109, 112.

Additional fundamental data are presented on possibilities and limitations of the die casting process.

14-235. Commentary on Pressure Die Casting. E. Carrington. *Light Metals,* v. 8, July '45, pp. 342-347.

Observations on a paper by J. L. Erickson.

14-236. Effective Shrink-Box Risers. Henry C. Winte and Tom Barlow. *Foundry,* v. 73, Aug. '45, pp. 82-86, 220, 222, 224.

Large percentage of porosity defects are directly attributable to poor gating and feeding design; theoretically and practically possible to design a system of gating and feeding which will cover a wide range of sizes, shapes, and metal characteristics if the principles of directional solidification are properly taken into account. 4 ref.

14-237. **Metallurgy of Iron and Steel for Castings.** J. E. Hurst. *Foundry,* v. 73, Aug. '45, pp. 90-91, 208.
Foundries adjusted to changed conditions prefer granular form ferrosilicon.

14-238. **Non-Ferrous Foundry Progress.** Frank Hudson. *Foundry,* v. 73, Aug. '45, pp. 92-93, 163, 164, 166.
Bronze and gunmetal castings; brass castings; special alloy castings; light alloy castings; adopt improved pouring practice; new inspection methods; effect in the postwar period. 5 ref.

14-239. **Foundry Research at Battelle Memorial Institute.** Edwin Bremer. *Foundry,* v. 73, Aug. '45, pp. 94-95.
Research facilities for the development of improved foundry practices and products.

14-240. **The Cumulative Curve for Foundry Sand Control.** Robert E. Morey and Howard F. Taylor. *Foundry,* v. 73, Aug. '45, pp. 98-101, 250, 252, 254, 256, 258, 260, 262, 264.
Technique for evaluating foundry sands and other particular foundry materials is intended to facilitate and improve control over the materials and provide a basis for adequate specifications governing their purchase. Because it opens a new approach to the classification of sand, clay, silica flour, this discussion is presented in order to stimulate wider study of the entire subject. 66 ref.

14-241. **Mechanizing the Small Jobbing Foundry.** W. S. Thomas. *Foundry,* v. 73, Aug. '45, pp. 109-110, 168, 172.
Layout shown.

14-242. **Precision Founding.** Francis Dittmar. *Iron Age,* v. 156, Aug. 2, '45, pp. 51-57.
Making of plaster-base investment molds. With the use of auxiliary examples shows how skillful employment of concealed venting and "cradles" makes for the reduction of gas pressures on the mold walls.

14-243. **Design Considerations for Die Casting.** H. W. Fairbairn. *Production Engineers' Journal,* v. 23, Nov. '44. *Engineers' Digest* (American Edition), v. 2, July '45, pp. 336-341.
Advantages of the pressure over the gravity casting process; improved surface finish; improved dimensional accuracy; ability to produce thinner wall sections; considerably improved rates of production. Hot chamber machines; goose-neck machines; cold chamber process.

14-244. **The Future of the Light Alloy Foundry Industry.** W. C. Devereux. *Machinery* (London), v. 67, July 5, '45, pp. 12-16.

Way in which mechanization has been employed to achieve very high outputs despite the shortage of skilled foundry workers. Merlin engine crankcase; alloys and alloy development; secondary alloys; magnesium alloys; research. (From Institute of British Foundrymen.)

14-245. **The Future of the Light Alloy Foundry Industry.** W. C. Devereux. *Foundry Trade Journal*, v. 76, July 5, '45, pp. 191-200.

Its important part in the critical years which lie ahead.

14-246. **Consistency and the Cupola.** C. A. Payne. *Foundry Trade Journal*, v. 76, July 5, '45, pp. 201-203.

Coke size variation; air supply; boshed wells; starting up details; torch lighting of cupolas; bosh profile.

14-247. **Microporosity in Magnesium Alloy Castings.** *Metallurgia*, v. 32, June '45, pp. 69-70.

Principal problem in casting magnesium alloys is microporosity which causes leakage when the castings are used for a number of purposes. The investigation was carried out to determine the primary causes of microporosity and to develop remedies. Conclusions and recommendations have resulted from facts observed in the study.

14-248. **Silico-Fluorides and Compounded Inhibitors in Magnesium Casting.** W. Wade Moss. *Light Metal Age*, v. 3, July '45, pp. 17-23, 44.

Sands, their handling, and preparation; general foundry practice and common inhibitors used in magnesium casting. Describes the preparation, function and advantages of silico-fluoride inhibitors.

14-249. **The Problem of the Measurement of Cupola Air Supply.** H. Pinchin. *Foundry Trade Journal*, v. 76, July 12, '45, p. 219.

Quantity of air delivered; solution to the problem; interpretation of blast records.

14-250. **Chill-Cast High Tin Bronze.** W. T. Pell-Walpole. *Metal Industry*, v. 67, July 13, '45, pp. 18-20.

Melting procedure determines the soundness and working properties of 14% tin bronze. Soundest and cleanest ingots are obtained by the use of solvent oxidizing-flux processes with efficient deoxidation. 5 ref. (From Institute of Metals.)

14-251. **An Investigation of the Constitution of Certain Foundry Bonding Clays.** R. W. Grimshaw and A. L. Roberts. *Foundry Trade Journal*, v. 76, July 19, '45, pp. 233-238.

Mineralogical nature of a clay by simple laboratory methods. 6 ref.

14-252. **Microporosity.** E. A. G. Liddiard and W. A. Baker. *Metal Industry*, v. 67, July 20, '45, pp. 34-37.

Occurrence of microporosity is largely due to the last fluid portions of the casting draining away from unfed sections. This effect is enhanced in magnesium

alloys because of their more rapid solidification. Result of an investigation made to find the causes and possible cure of the trouble. (From Institute of British Foundrymen.)

14-253. **Mold and Core Paints and Washes, and Parting Powders.** W. J. Rees. Iron & Steel Institute, Advance Copy, June '45, 4 pp.

Investigation on non-siliceous alternatives to silica flour for parting powders and mold and core paints. Alternatives to silica flour for parting powders which are quite satisfactory in foundry use are indicated. The trials made with mold and core paints indicate that silica flour can be satisfactorily replaced by non-siliceous materials. Calcined ball clay or aluminous fireclay is satisfactory for small and medium steel castings; for larger castings sillimanite, calcined or fused, and zircon have given satisfactory results.

14-254. **Microporosity—Cause and Control in Magnesium Alloys.** E. A. G. Liddiard and W. A. Baker. *Metal Industry,* v. 67, July 27, '45, pp. 56-58.

Cause and effects of microporosity in magnesium and aluminum alloys; mode of solidification, effect of beryllium, chill casting and alloy deficiencies in the later solidifying portions of the castings.

14-255. **Precision Founding.** Francis Dittmar. *Iron Age,* v. 156, Aug. 16, '45, pp. 70-74.

Theory and practice of precision casting; the author continues his discussion on making of matrices, modeling of waxes, plaster carrying and production sequences in casting.

14-256. **Microporosity.** E. A. G. Liddiard and W. A. Baker. *Metal Industry,* v. 67, Aug. 3, '45, pp. 70-71.

Cause and control in magnesium alloys; explanation of differences; technique of casting; foundry application.

14-257. **Precision Founding.** Francis Dittmar. *Iron Age,* v. 156, Aug. 23, '45, pp. 74-81.

Use of nitrogen gas for refining molten metal in order to increase its fluidity during the casting step. Three types of centrifugal casting are analyzed and the mold design suitable for each is discussed.

14-258. **Pearlitic Rim in Malleable Iron.** J. E. Rehder. *Canadian Metals and Metallurgical Industries,* v. 8, Aug. '45, pp. 29-31, 45.

Formation due to oxidation of silicon, increasing stability of cementite. 5 ref.

14-259. **The Future of the Light Alloy Foundry Industry.** W. C. Devereux. *Engineering,* v. 160, July 27, '45, pp. 77-80.

Illustrates, by way of example, the manner in which mechanization has been employed to achieve very high outputs despite the severe shortage of skilled foundry workers.

14-260. **Gadgets and Methods of Supporting Cores Useful to the Jobbing Molder.** H. Holdsworth. *Foundry Trade Journal,* v. 76, July 26, '45, pp. 261-263.

Low cost of parts which are, at least in overseas foundries, general foundry stock or can be made by the molder in a few minutes.

14-261. **Porosity and Shrinkage in Non-Ferrous Castings.** *Iron Age,* v. 156, Aug. 30, '45, pp. 36L-36N.

Most obstinate sources of defects in castings are the volume changes in metals, especially the shrinkage occurring during solidification, and the absorption and liberation of gases from metals. Five principal factors are involved in the formation of shrinkage defects.

14-262. **Spinning of Copper-Base Alloys.** W. P. Gobeille and W. J. Hufschmidt. *Iron Age,* v. 156, Aug. 30, '45, pp. 42-46.

Attention is directed to the spun-cast method for other than straight-wall castings, particularly for aluminum, manganese, tin, lead, and nickel bronzes. A number of the products shown, made by true centrifugal, semi-centrifugal, and centrifuging methods, have been achieved only within recent months.

14-263. **Die Casting Close-Fit Threads.** R. E. McIntosh. *Iron Age,* v. 156, Aug. 30, '45, pp. 50-53, 96.

Close-fit threads are secured without tapping or chasing, by die casting in zinc alloy. There is no parting in the axial plane; hence there is no flash on the thread itself.

14-264. **The Modern High Pressure Die Casting Machine.** James L. Erickson. *Light Metal Age,* v. 3, Aug. '45, pp. 12-14, 31.

Critical examination of the modern cold chamber die casting machine in the light of the physical metallurgy involved in the production of pressure die castings. Underlying principles of the modern die casting machine are discussed and desirable mechanical features are considered and summarized.

14-265. **Silico-Fluorides and Compounded Inhibitors in Magnesium Casting.** W. Wade Moss. *Light Metal Age,* v. 3, Aug. '45, pp. 21-28, 31-32, 49.

Components involved in the production of sound magnesium castings.

14-266. **The Future of the Light Alloy Foundry Industry.** W. C. Devereux. *Aircraft Production,* v. 7, Aug. '45, pp. 401-406.

Survey of its present condition and future needs.

14-267. **New Malleable Foundry Is Modern.** *Foundry,* v. 73, Sept. '45, pp. 84-88, 226, 228.

Many plants erected rapidly; raw materials stored under cover; castings are inspected; equipped with safety devices.

14-268. **Molding Large Cast Iron Crankshafts.** George Johnstone. *Foundry,* v. 73, Sept. '45, pp. 89, 232, 234.

Three recognized methods of casting large crankshafts include: (1) Vertical pouring and cooling; (2) horizontal pouring and vertical cooling; (3) horizontal pouring and horizontal cooling. Advantages and disadvantages of each method.

14-269. **Housekeeping—Essential in Accident Prevention.** Ralph R. Meigs. *Foundry,* v. 73, Sept. '45, pp. 90-91, 254-257.

More than storage space needed; good housekeeping principles; avoid defective equipment; maintain clean floors; housekeeping is continuous.

14-270. **Foundry Research at American Brake Shoe Co.** William G. Gude. *Foundry,* v. 73, Sept. '45, pp. 94-97, 196, 198.

What one large producer of castings is doing to improve foundry practices and develop new products is described.

14-271. **Reclaiming Core Sand.** James O. Sinkinson. *Foundry,* v. 73, Sept. '45, pp. 104-106, 222, 224.

Process will be of particular benefit to those foundries which do not have convenient railroad sidings, or are faced with the always difficult problem of disposing of used sand. Description of process.

14-272. **Mechanization of Iron and Steel Foundries.** J. W. Gardom. *Foundry,* v. 73, Sept. '45, pp. 98-101.

Wartime developments in the British foundry industry.

14-273. **Eliminating Troubles in Casting Bronze and Aluminum.** Anthony Cristello. *Foundry,* v. 73, Sept. '45, pp. 110-111, 162, 164, 166, 168, 170, 172, 174, 178.

Factors to be watched in overcoming some of the principal problems encountered in bronze and aluminum founding.

14-274. **Thermit Casting Technique.** R. T. Brown. *Steel,* v. 117, Sept. 3, '45, pp. 134, 137, 188, 190.

Produces high grade steel castings; of any size, in limited quantities, with improvised equipment.

14-275. **Future of the Light Alloy Foundry Industry.** *Light Metals,* v. 8, Aug. '45, pp. 376-377.

War years, which have seen grow to maturity the aluminum and magnesium foundry industry in this country, have left as a legacy many severe economic problems which must be resolved at an early date. Nature of these problems and means of approach to their solution.

14-276. **Graphite Molds for Short-Run Castings.** John Putchinski. *Iron Age,* v. 156, Sept. 6, '45, pp. 83-85, 170, 172, 174.

In view of the better controls being introduced and more complicated shapes being cast centrifugally, the use of graphite molds shows considerable promise. Graphite inserts may eliminate machining operations such as hole boring, and undercuts and irregular contours will eventually be cast rather than machined.

14-277. **Initial Experience in Hydraulic Cleaning in a Steel Foundry Fettling Shop.** F. N. Lloyd. *Foundry Trade Journal,* v. 76, Aug. 9, '45, pp. 297-303.

Hydro-Blast process, employing a stream of water and sand at a pressure of 1200 lb., deals with the initial experiences of operating the process.

14-278. **Symposium on Continuous Casting.** *Metal Treatment,* v. 12, summer '45, pp. 128-129.

Fundamentals of the process; Goss process; direct rolling of strip; the Soro process; Williams process.

14-279. **Future of the Light Alloy Foundry Industry.** W. C. Devereux. *Metal Treatment,* v. 12, summer '45, pp. 130-133, 136.

Growth and achievements of light alloy foundries during the war. Abridged. (Institute of British Foundrymen.)

14-280. **Initial Experience in Hydraulic Cleaning in a Steel Foundry Fettling Shop.** F. N. Lloyd. *Foundry Trade Journal,* v. 76, Aug. 16, '45, pp. 319-324.

Operation of plant; sand reclamation.

14-281. **An Investigation of the Constitution of Certain Foundry Bonding Clays.** R. W. Grimshaw and A. L. Roberts. *Foundry Trade Journal,* v. 76, Aug. 16, '45, pp. 325-328.

An approach to a true synthetic bond. Characteristics of bentonite; American practice; presence of combustible matter; differential temperature; rehydration tests.

14-282. **Mold and Core Paints and Washes and Parting Powders.** W. J. Rees. *Refractories Journal,* v. 21, July '45, pp. 266-269.

Inception of the investigation on non-siliceous alternatives to silica flour for parting powders and mold and core paints is described. Alternatives to silica flour for parting powders which are quite satisfactory in foundry use are indicated. The trials made with mold and core paints indicate that silica flour can be satisfactorily replaced by non-siliceous materials. Calcined ball clay or aluminous fireclay is satisfactory for small and medium steel castings; for larger castings sillimanite, calcined or fused alumina, and zircon have given satisfactory results. The choice of the most suitable alternative depends on the particular condition of foundry practice.

14-283. **Supercharger Buckets Mass Produced by Precision Casting.** Arthur E. Focke. *Metal Progress,* v. 48, Sept. '45, pp. 489-494.

Molding and casting process, using the so-called lost wax process long employed for casting dentures and metal appliances for bone surgery, provided the means of obtaining buckets of cobalt-chromium-tungsten alloy in the desired shape, and close enough to size so that final grinding could be more a means of touching up rather than a sizing operation involving actual stock removal.

14-284. **Checking of Die Casting Dies.** James L. Erickson. *Iron Age,* v. 156, Sept. 20, '45, pp. 64-67.

Necessity over the past few years of obtaining maximum life from die casting dies has increased interest in the causes of fatigue failures. Effects of temperature gradients in increasing the compressive and tensile stresses in the die and thus hastening thermal cracking and the possibility of reducing coefficients of expansion of new die materials for longer die life are discussed.

14-285. **Aluminum and Magnesium.** W. C. Devereux. *Automobile Engineer,* v. 35, Aug. '45, pp. 323-326.

Advances that have been made in the production of both aluminum and magnesium alloys are clearly shown. To illustrate the progress made in manufacturing processes brief reference is made to a modern large-scale mass production factory. Price trends are discussed and

probable developments in the next few years are broadly forecast.

14-286. **What Are the Limitations of Die Castings?—A Discussion.** *Die Casting,* v. 3, Sept. '45, pp. 50-53.

Need for research to improve die castings; "blow holes"; partings; gate and ejector marks; tolerances; sizes change; variety of die casting; thinner sections; lower die costs; checking of dies; design of castings.

14-287. **Re-Melt for Tin-Base Alloy Pressure Die Castings.** K. Hiawatsch. *Machinery* (London), v. 67, July 26, '45, pp. 106-107.

One way of helping to prevent gravity segregation from taking place is to maintain a reasonably high temperature, thereby creating a favorable distribution of antimony, lead and tin-copper crystals in the melt, and fixing and perpetuating it by rapid solidification. Gives results of tests.

14-288. **Whiteheart Malleable.** A. G. Robiette. *Iron and Steel,* v. 18, Aug. '45, pp. 383-386.

Whiteheart malleable iron can be produced without recourse to packing in ore, but the high cost of the atmosphere needed has been a deterrent. Describes a method whereby the cost can be cut to a small fraction. (Institute of British Foundrymen.)

14-289. **Investigation of Metal Pouring by Ciné Photography.** *Metallurgia,* v. 32, July '45, pp. 135-136.

New technique developed to enable the examination of the flow of metal as it enters a mold.

14-290. **Magnesium Ingots.** P. Menzen and W. Patterson-Rackwitz. *Metal Industry,* v. 67, Sept. 7, '45, pp. 150-152.

Magnesium alloys can be cast by the continuous casting process even when direct liquid cooling is employed. Use of the continuous casting process on a production scale confirmed. Improvements resulting from its employment; also shows considerable technical and economic advantages. (From *Aluminium.*)

14-291. **Gravity Die Casting.** A. R. Palmer. *Foundry Trade Journal,* v. 76, Aug. 23, '45, pp. 339-346.

Die design; choke runner for piston castings; die construction; venting; mechanical aids; loose pieces; collapsible cores; sand cores; inserts; coating of the dies; melting and maintaining temperature control.

14-292. **Initial Experience in Hydraulic Cleaning in a Steel Foundry Fettling Shop.** F. N. Lloyd. *Foundry Trade Journal,* v. 76, Aug. 23, '45, pp. 347-350, 346.

Capacity and operating cost.

14-293. **Cause and Control of Magnesium Alloy Microporosity.** E. A. G. Liddiard and W. A. Baker. *American Foundryman,* v. 8, Sept. '45, pp. 33-44.

Cause and control of microporosity in magnesium alloys attest the value of this broad exchange of knowledge and ideas for the common advancement of the foundry industry.

14-294. **Castings Should Always be Qualified in the Foundry.** O. O. Gammon. *American Foundryman,* v. 8, Sept. '45, pp. 54-56.

Methods of casting qualification in the foundry to reduce machine tool costs and facilitate machining. A particular point is the use of less highly skilled operators.

14-295. **Split Type Specimen Tube for Elevated Temperature Sand Testing.** D. C. Williams. *American Foundryman,* v. 8, Sept. '45, pp. 68-72.

Reproducibility of hot compressive strength values when using two different type cylindrical specimen tubes. 3 ref.

14-296. **Postwar Operations of Aluminum Foundries.** W. H. Gunselman. *American Foundryman,* v. 8, Sept. '45, pp. 73-76.

Operational controls have enabled foundries in general to meet the specifications demanded for certain wartime castings. Continued rigid controls will retain the confidence of designers and result in wider postwar applications of cast metals as engineering materials. Properly organized maintenance and sales forces will have important parts in the postwar foundry.

14-297. **Some Production Control Principles and Their Application to the Manufacture of Steel Castings.** A. B. Lloyd. *Foundry Trade Journal,* v. 76, Aug. 30, '45, pp. 359-366.

Method of control is disclosed, which efficiently coordinates the commercial and manufacturing activities of a steel foundry.

14-298. **Low Alloy Steels.** Lester W. Gott. *Iron & Steel,* v. 18, Sept. '45, pp. 426-429.

Precision casting by the "lost wax" process. High speed production; intricate designs; new refractories used; molds baked; gravity pouring; production economies; mechanical properties; homogenizing heat treatment; limitations discussed.

14-299. **A Study of Molding Methods for Sound Castings.** Frederick G. Sefing. *Foundry Trade Journal,* v. 77, Sept. 13, '45, pp. 25-34.

Clean metal and gate design; position of gates and feeders; effective feeder design; feeder capacity; feeder connections; chills; venting mold cavities; porosity caused by hot spots.

14-300. **Pouring Light Metals.** Carl Wessel. *Light Metal Age,* v. 3, Sept. '45, pp. 17, 34.

Fundamental suggestions on pouring, drawn from practice, are important to the production of sound castings.

14-301. **The Literature of Die Casting.** James L. Erickson. *Light Metal Age,* v. 3, Sept. '45, pp. 25, 27, 29, 31.

Complete bibliography on die castings. 353 ref.

14-302. **Magnesium Ingots.** P. Menzen and W. Patterson-Rackwitz. *Metal Industry,* v. 67, Sept. 21, '45, pp. 185-186.

Continuous casting process with direct liquid cooling.

14-303. **Magnesium Die Castings.** Max Powell and C. H. Scott. *Product Engineering,* v. 16, Oct. '45, pp. 692-696.

Design data for magnesium die castings with factors that should be considered to obtain quality in product

and economy in production. Features include parting line, draft, tolerances, stationary and movable cores, wall thickness, cast threads, machining allowances, ejectors, inserts, size and weight limitations, porosity and shrinkage.

14-304. **Mechanized Mold Preparation.** *Steel,* v. 117, Oct. 8, '45, pp. 107, 156.

Effects reduction in scrap and scarfing.

14-305. **Die Casting.** J. L. Erickson. *Metal Industry,* v. 67, Sept. 28, '45, pp. 194-197.

Transition from the first frail die casting machine to the mammoth piece of elaborate machinery existing today for this work is dealt with. Traces the reasons for the capability of machines with high injection pressures. Value of a high pressure machine does not lie in its ability to make superior small castings but merely in its ability to make large castings when small gates are used or to make small gates when multiple cavity dies are employed.

14-306. **Precision Founding—Part 8.** Francis Dittmar. *Iron Age,* v. 156, Oct. 11, '45, pp. 62-68.

Analyzes the use of refractory materials in several types of molds suitable for steel castings, and the operating factors involved in centrifugal casting.

14-307. **Alrok Treatment Avoids Masking Cast-In Inserts.** A. J. Ferko. *Iron Age,* v. 156, Oct. 11, '45, pp. 69-70.

Tests indicate that castings of aluminum alloys 40E, 195 and 356 with cast-in inserts need not have the inserts masked when given the Alrok treatment, as would be necessary in the case of the anodized treatment for passivation.

14-308. **Magnesium Ingots.** P. Menzen and W. Patterson-Rackwitz. *Metal Industry,* v. 67, Sept. 14, '45, pp. 165-166.

Continuous casting process with direct liquid cooling.

14-309. **High Tensile Steel for Castings.** W. West, C. C. Hodgson and H. O. Waring. *Foundry Trade Journal,* v. 77, Sept. 20, '45, pp. 47-52.

Analogies with forged steel provide useful pointers for progress. Plant and equipment; steel-making practice; hydrogen and flakes; control of inherent grain size; control of sulphide distribution; temperature measuring; facilitating repairs and maintenance. 8 ref.

14-310. **Working Under Pressure.** Nigel J. Collings. *Die Casting,* v. 3, Oct. '45, pp. 38-40.

By using unit cavity dies, parts inventory control is greatly facilitated. At the same time the production economies attained rapidly amortize die costs.

14-311. **Pumping Molten Magnesium.** M. M. Moyle. *Metals & Alloys,* v. 22, Sept. '45, pp. 716-720.

Practical use of newly developed equipment for pumping molten metals in foundries and ingot plants.

14-312. **Continuous Production of Steel Castings.** Gerald Eldridge Stedman. *Metals & Alloys,* v. 22, Sept. '45, pp. 735-741.

Advanced practice in the production of steel castings, as exemplified by the modern Pittsburg, Cal., foundry of Columbia Steel Co.

14-313. **Die Casting Methods in Germany Far Behind Those of U. S. and Britain.** A. T. Lillegren. *Steel,* v. 117, Oct. 1, '45, pp. 115, 164.

Finishing equipment; production rates; die cast materials.

14-314. **Iron Casting Runners and Feeding Heads.** T. Waterfall. *Machinery* (Lloyd), v. 17, Sept. 1, '45, pp. 70-74.

Jobbing iron foundry; cause of bad runners; area of mold; position of runners; top oreing; planning the runners; pouring precautions; rate of casting; influence of mass; distortion and internal stress; machining properties; area of runners; dimensions of runner system.

14-315. **Use of Insulating Pads and Riser Sleeves for Producing Sound Bronze Castings.** Howard F. Taylor and William C. Wick. *Foundry,* v. 73, Oct. '45, pp. 88-93, 158, 160, 164, 166, 168, 171, 175.

Emphasizes the dependence of good foundry practice upon proper gating and risering, and demonstrates how use of insulating pads and riser sleeves contributes to casting quality and operating economy. 6 ref.

14-316. **Trouble Shooting in the Magnesium Foundry.** Charles J. Scullin. *Foundry,* v. 73, Oct. '45, pp. 97-98, 200. 202.

Observing physical forces through artificial windows, ruby glass or something of that nature, it is possible actually to see what is occurring at the point where defect is found. This is especially effective in regard to the point of final coverage of a core.

14-317. **Small Brass Foundry Maintains Good Production.** Edwin Bremer. *Foundry,* v. 73, Oct. '45, pp. 104-105, 175-176, 178.

Production of 7000 to 8000 lb. of brass and bronze castings. Castings range from 1 oz. to 1000 lb. in weight, and, as a general rule, the larger castings are made by the night shift, since more room is available at that time. Description of equipment.

14-318. **Navy Yard Foundry Meets Peak Demands.** Pat Dwyer. *Foundry,* v. 73, Oct. '45, pp. 106-109, 180, 184, 186, 188.

Describes foundry operations at the Philadelphia Navy Yard.

14-319. **Foundry Research At International Nickel Co.** *Foundry,* v. 73, Oct. '45, pp. 110-113.

Facilities and activities.

14-320. **Metal Mold Castings.** D. Basch. *Metal Progress,* v. 48, Oct. '45, pp. 761-768.

Centrifugal and permanent mold castings, and three varieties of die castings—from basin machines, from cold chamber machines, and pressure molded casting machines. Alloy analyses; typical properties of die cast test bars; commercial tolerances; appraisal of relative characteristics.

14-321. Gas Evolution From Cast Steel at Room Temperature. H. H. Johnson, L. H. Arner and H. A. Schwartz. American Society for Metals Preprint 14, 1945, 24 pp.

Composition and rate of evolution of gas, evolving from freshly cast steel at or near room temperature studied. The gases consist mainly of CO, N_2 and H_2. Electric intermediate manganese steels differ little among themselves in the total of the two former gases evolved per unit weight of steel but vary greatly in the amount of hydrogen. Amount of gas evolved and the rate of evolution increases with temperature. Neither varies significantly with the ratio of surface to volume of the specimen. Rate of evolution varies with the partial pressure of the evolved gases in the ambient atmosphere, but the amount varies but little. Volume of gas evolved is related to time by the equation of the "first order" reaction or by the sum of several such equations. Only a small portion of the H_2 and N_2 recoverable by combustion or by wet analysis respectively is evolved at room temperature.

14-322. Tellurium Corewashes. James O. Vadeboncoeur. American Society for Metals Preprint 31, 1945, 6 pp.

Tellurium-base corewashes have solved troublesome gray iron foundry problems. They have been particularly successful in the prevention of shrinks, but care in application must be emphasized since porosity and migrated chills are often the result of careless supervision in preparation and use. Several mixtures used on mass production are described, and the possible mechanism of the action of tellurium in corewashes is discussed.

14-323. Magnesium Foundry. *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 31-34.

Careful consideration of all the functions to be performed, bearing in mind the necessity of reducing internal transport and the movement of materials to a minimum, coupled with optimum conditions from an operation and ventilation point of view, led to the type of building and lay-out described.

14-324. High Tensile Steel for Castings. W. West, C. C. Hodgson and H. O. Waring. *Foundry Trade Journal,* v. 77, Sept. 27, '45, pp. 69-76, 80.

Relationship between type of primary structure and mechanical properties; heat treatment; preliminary treatment; hardening; tempering; mechanical properties; chemical composition. 3 ref.

14-325. Centrifugal Casting Improves Quality. *Western Machinery and Steel World,* v. 36, Oct. '45, pp. 454-456.

New type centrifugal casting installation is an integral part of its up-to-date foundry equipment recently completed by Axelson Manufacturing Co.

14-326. Precision-Cast Copper-Base Alloys. S. Lipson, H. Markus and H. Rosenthal. *Iron Age,* v. 156, Nov. 1, '45, pp. 46-49.

Presents some of the data collected on four copper-base alloys—leaded red brass (85-5-5-5), leaded yellow brass (60-40), high-strength manganese bronze and silicon brass. Procedures and techniques used in casting the test specimens are fully described.

14-327. Steel Castings Replace Forgings. E. B. Bromhead and T. E. Piper. *Iron Age,* v. 156, Nov. 1, '45, pp. 50-51.
Generally considered unreliable from a quality standpoint, alloy steel castings are made to aircraft quality standards and prove highly efficient as structural members by virtue of their high weight-strength value.

14-328. New Foundry Is Model of Mechanization. *Steel,* v. 117, Nov. 5, '45, pp. 132-134.
New foundry of streamlined efficiency at Ashtabula, Ohio, designed to incorporate the latest development of foundry equipment available in America.

14-329. Microporosity in Magnesium Alloy Castings. W. A. Baker. *Canadian Metals & Metallurgical Industries,* v. 8, Oct. '45, pp. 37-38, 40.
Objects of the present investigation were to determine the primary causes of microporosity, to study the contributory factors governing its incidence, and if possible, to develop remedial measures. Sand castings of magnesium-aluminum and other magnesium-base alloys were examined, and in some cases were compared with similar aluminium-base alloy castings. Work was done on a laboratory scale and the test castings were of simple form in order to minimize molding variables and to facilitate examination of the castings. It is evident that microporosity in magnesium alloy castings is primarily due to shrinkage. Suggests remedies.

14-330. Plaster Mold Castings. N. B. Barnard. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1085-1089.
Advantages and limitations; typical applications; the future.

14-331. Pressure Die Casting. *Light Metals,* v. 8, Oct. '45, pp. 471-478, 515-518.
Answering criticisms of his investigations (and the conclusions drawn from these) by E. Carrington, J. L. Erickson enlarges on his own explanation of the mechanism of metal flow and gas entrapment in pressure dies. Carrington's interpretation of the results obtained by certain continental workers is also questioned. Carrington's reply. 4 ref.

14-332. Foundries of the Future. J. B. Lamenzo. *Foundry,* v. 73, Nov. '45, pp. 84-87, 238, 240, 242, 244, 246.
Describes sand conditioning systems in operation in various foundries.

14-333. Collectors on Cupolas Clean Waste Gases. Arthur H. Allen. *Foundry,* v. 73, Nov. '45, pp. 88-90, 199, 200.
Gives description of one of the collector units and theory of its action.

14-334. Physical Testing of Core Binding Materials. Carl E. Schubert. *Foundry,* v. 73, Nov. '45, pp. 91, 192, 195.
Physical tests when performed correctly do help the manufacturer of core oils to produce even stronger core binders at less cost to the buyer. Also help the purchaser because they act as a check on the quality and uniformity

of the core oil being purchased. Suitable tests for both seller and purchaser are outlined.

14-335. **Gray Iron Production for War.** James S. Vanick. *Foundry,* v. 73, Nov. '45, pp. 96-101, 226, 228, 230, 232, 234, 236.
How the gray iron foundry industry of the United States adjusted itself in the shift from civilian to military castings. Paper was prepared for presentation at the first postwar congress of the French Foundry Association in Paris, Oct. 19-20. 2 ref.

14-336. **Malleable Foundry Design.** *Foundry,* v. 73, Nov. '45, pp. 102-105, 156.
Depicts some of the architectural and design features of the malleable iron plant near Danville, Ill., operated by the Saginaw Malleable Iron Division, General Motors Corp.

14-337. **Use of Insulating Pads and Riser Sleeves for Producing Sound Bronze Castings.** Howard F. Taylor and William C. Wick. *Foundry,* v. 73, Nov. '45, pp. 106-111, 260, 262.
Discusses additional applications of insulating pads and risers to eliminate shrinkage. Procedure for making these sleeves and pads is detailed.

14-338. **Foundry Research in the Chilled Car Wheel Industry.** Edwin Bremer. *Foundry,* v. 73, Nov. '45, pp. 112-114, 264-265.
Influence of research in improving the quality of cast iron chilled car wheels is discussed.

14-339. **The Foundry Data Sheet.** *Foundry,* v. 73, Nov. '45, pp. 139-140.
Determining weights of castings from blueprint data; specific gravity and density of common casting alloys; melting points of various materials used in the foundry.

14-340. **Superheating of Magnesium Alloys.** N. Tiner. *Metals Technology,* v. 12, Oct. '45, T.P. 1935, 19 pp.
Presents principal facts concerning the effect of superheating on grain size of magnesium alloys. Attempts made to explain the experimental results in terms of a general hypothesis. Investigations are limited chiefly to common commercial casting alloys. 17 ref.

14-341. **Cylinder Liners for Diesel Engines.** W. W. Levi. *Vancoram Review,* v. 4, Summer, '45, pp. 6-7, 18.
Describes molding practice and specifications for gray cast iron liners.

14-342. **Structure Control of Gray Cast Iron, Part II.** R. G. McElwee and Tom E. Barlow. *Vancoram Review,* v. 4, Summer '45, pp. 8-10, 18-19.
Choice of inoculant, amount to use, methods of adding it, and use in correcting analysis are described.

14-343. **Industrial Status of Precision Castings.** W. A. Morey. *American Foundryman,* v. 8, Oct. '45, pp. 33-38.
Developments in the precision casting process have made possible volume production of small, intricate parts allowing almost unlimited choice of materials.

14-344. Sand Control in a Malleable Iron Foundry. Gordon Davis. *American Foundryman,* v. 8, Oct. '45, pp. 65-67.

Different sands used; sand conditioning equipment; sands for light castings; sands for medium size castings; sands for heavy castings; sea coal added.

14-345. Relative Effect of Lime and Dolomite Fluxes on Cupola Iron and Cupola Operation. C. C. Sigerfoos and H. L. Womochel. *American Foundryman,* v. 8, Oct. '45, pp. 68-71.

Describes experiments performed to determine the effect of substituting dolomite for limestone as a cupola flux. Data presented to show the effect of the slags on the sulphur, carbon, silicon, phosphorus and manganese contents of the irons, and on their physical properties.

14-346. Large Aluminum Rotors are Pressure-Cast. *Product Engineering,* v. 16, Nov. '45, p. 760.

Three sizes of pressure-cast aluminum rotors are shown here: A 5¼-in. rotor used in a 1½-hp., 1800-r.p.m. motor; a 20-in. rotor used in motors of 200 hp.; 30-in. rotor in special purpose 250-hp., 360-r.p.m. motors for the new automotive presses.

14-347. High Tensile Steel for Castings. W. West, C. C. Hodgson and H. O. Waring. *Foundry Trade Journal,* v. 77, Oct. 4, '45, pp. 101-104.

Analogies with forged steel provide useful pointers for progress.

14-348. Die Casting Aluminum. R. D. McGilvra. *Modern Metals,* v. 1, Nov. '45, p. 20.

Outlines history of the process, as well as some typical applications.

14-349. The Literature of Die-Castings, Part II. *Light Metal Age,* v. 3, Oct. '45, pp. 27, 29, 48.

Most complete listing of published material concerning die casting.

14-350. High Production Casting to Close Tolerances. Wallace A. Scotten. *Production Engineering & Management,* v. 16, Nov. '45, pp. 67-70.

Successful adaptation of a "lost wax" method of casting non-ferrous metals has enabled the mass production of small and intricate parts without benefit of usually difficult machining operations. Castings are held to finish tolerances.

14-351. Precision-Cast Copper-Base Alloys, Part II. S. Lipson, H. Markus and H. Rosenthal. *Iron Age,* v. 156, Nov. 8, '45, pp. 64-73.

Experimental data on precision-cast leaded red brass, leaded yellow brass, manganese bronze and silicon brass are presented and the effects of such factors as flask temperatures and prequench time intervals on the physical properties and microstructure of these castings are discussed.

14-352. Permanent-Mold Castings. L. F. Swoboda. *Aircraft Production,* v. 7, Oct. '45, pp. 499-501.

Survey of the advantages of the process; cost and design considerations. (Abstract of paper for Society of Automotive Engineers.)

14-353. **Automatic Casting.** K. Hoffmann. *Metal Industry,* v. 67, Oct. 19, '45, pp. 242-244.

New machine is stated to be suitable for the casting of light metal ingots as well as for the casting of ingots and slabs of lead, tin, zinc, copper and their alloys. (From *Zeitschrift fur Metallkunde.*)

14-354. **Properties of Some Magnesium-Aluminum-Zinc Casting Alloys and the Incidence of Microporosity.** F. A. Fox. *Metallurgia,* v. 32, Sept. '45, pp. 227-228.

The work was done in two parts, the first being concerned with the static mechanical properties of the alloys in the cast and the heat treated states, and the second with the incidence of microporosity in the various alloys in relation to composition. (From Institute of Metals.)

14-355. **The Modern Specialized Foundry.** William Jones. *Foundry Trade Journal,* v. 77, Oct. 18, '45, pp. 135-138, 142.

Features of the foundry; sand mixing, distribution and returns; dust-extraction plant; core department; fettling arrangements.

14-356. **A Study of Molding Methods for Sound Castings.** Frederick G. Sefing. *Foundry Trade Journal,* v. 77, Oct. 18, '45, pp. 139-142.

Discussion on the American Foundrymen's Association Exchange Paper read at the annual meeting of the Institute of British Foundrymen.

14-357. **Substitutes for Silica Flour in the Foundry.** Harold Shaw. *Foundry Trade Journal,* v. 77, Oct. 18, '45, pp. 143-144.

Chamotte; zirconium silicate; molochite; olivine; other substitutes.

14-358. **Magnesium Foundry.** *Aluminum & Magnesium,* v. 2, Nov. '45, pp. 22-25.

The mechanized foundry; plant and equipment; machine molding section.

14-359. **Methods of Production in the Post-War Foundry.** William Peacock. *Foundry Trade Journal,* v. 77, Oct. 25, '45, pp. 163-164.

Coreshop layout; molding bays; maintenance; production level.

14-360. **The Removal of Gases from Molten Bronzes.** *Industrial Heating,* v. 12, Nov. '45, p. 1934.

In the absence of elements with a high affinity for oxygen, which form comparatively insoluble oxides, hydrogen may be eliminated by oxidation of the melt, followed by deoxidation to remove the excess of oxygen added. Hydrogen can be readily removed by scavenging treatments with inert gases or by the addition to the charge of substances which evolve inert gases during melting. (Paper for Institute of Metals.)

14-361. **Porosity in Navy G and M Metals and Red Brasses.** William B. George. *Iron Age,* v. 156, Nov. 15, '45, pp. 68-70.

Discussion limited to cylindrical casting approximately 16 in. i.d. by 18 in. o.d. by 24 in. long, finished and capable of withstanding 250 lb. of air pressure. Finished casting must be free of all imperfections and subject to test pieces cut from any section to check physical properties.

14-362. Precision Casting With Plastic Patterns. Charles T. Post. *Iron Age,* v. 156, Nov. 15, '45, pp. 54-59.

Use of injection molded polystyrene patterns overcomes the problems of perishability found with wax patterns while affording high dimensional accuracy, smooth finish and reproducibility on long runs.

14-363. Pattern Redesign for Increased Production. Ernest C. Moorhead. *American Foundryman,* v. 8, Nov. '45, pp. 26-28.

Points out how small pattern changes can greatly increase foundry production and save a lot of supervision and attention on jobs in the "breaking even bracket".

14-364. Steel Castings Repair Methods. J. F. Cotton. *American Foundryman,* v. 8, Nov. '45, pp. 29-34.

Three principal methods for the removal of defects: Chipping, grinding, and flame gouging. Advantages and disadvantages of each discussed.

14-365. Density of Light Alloy Castings. M. W. Daugherty and L. W. Kempf. *American Foundryman,* v. 8, Nov. '45, pp. 38-43.

Discusses possible errors involved in use of density determination for measuring soundness of castings. Suggests some methods for reducing these errors to a minimum and illustrates application of the methods. Some observations made on practical significance of variations in density of castings. 1 ref.

14-366. The Influence of Radiation Within Molding Sand on the Freezing Rate of Metal. H. A. Schwartz. *American Foundryman,* v. 8, Nov. '45, pp. 45-48.

Relation of amount of metal frozen to time cannot be satisfactorily explained if conductivity of molding sand is taken as independent of temperature. A better correlation can be obtained if heat transfer within the sand is assumed to be in part by conduction and in part by radiation. 2 ref.

14-367. Malleable Sand Control in a Large Mechanized Foundry. Joseph J. Clark. *American Foundryman,* v. 8, Nov. '45, pp. 49-56.

Describes materials, equipment and controls employed in synthetic, all-facing sand systems of a modern, high production malleable iron foundry, producing medium finish automotive and gun part castings, weights ranging from a few ounces to 65 lb.

14-368. A New Method of Investigating the Behavior of Charge Material in an Iron Foundry Cupola and Some Results Obtained. N. E. Rambush and G. B. Taylor. *Foundry Trade Journal,* v. 77, Nov. 8, '45, pp. 197-204, 212.

Principle of investigation; preparation for test; procedure of test; observations on stripping; position and nature of metallic charge; state and nature of coke; condition of lining. (Paper for Institute of British Foundrymen.)

14-369. The Cause and Control of Microporosity in Magnesium Alloys. E. A. G. Liddiard and W. A. Baker. *Foundry Trade Journal,* v. 77, Nov. 8, '45, pp. 205-207.

Discussion on a paper presented at the annual meeting of the Institute of British Foundrymen.

14-370. **Lost Wax at Work.** Edwin Laird Cady. *Scientific American,* v. 173, Dec. '45, pp. 334-336.

Precision castings can be produced commercially by the lost-wax process, but not by "off-in-the-corner" methods. Materials, processing, and equipment must be fitted to the job in hand; then lost wax can show outstanding advantages in accuracy and scrap reduction.

14-371. **What Type Charger and Charging Bucket?** A. W. Gregg. *Foundry,* v. 73, Dec. '45, pp. 84-87, 228, 230, 232.

Factors to be considered: Quality of product to be cast; size of the cupola; maximum tonnage and minimum tonnage per hour and per day to be handled into the cupola; number of hours the cupola is in operation; size of the metal charge; coke ratio; density of the metallic charge; largest pieces and kind of scrap used.

14-372. **Foundries of the Future. Part 2.** J. B. Lamenzo. *Foundry,* v. 73, Dec. '45, pp. 88-93, 258, 260, 262.

Discusses improvements in sand and mold handling facilities.

14-373. **Opinions on Graphitization.** Lester Crome. *Foundry,* v. 73, Dec. '45, pp. 102-103, 248, 250, 252, 254, 256, 258.

Locations higher in carbon than others are considered as potential nuclei for graphitization. Particles other than carbide precipitated from the solid may also serve as nuclei. Relations of pouring temperature, inoculation, quenching, etc., to these factors are briefly discussed. Pre-existing graphite particles have an attractive power for carbon; thus decomposition of pearlite varies with their presence or absence. Diffusion rates of carbon in austenite and ferrite govern behavior. These rates are affected by alloying elements. Aluminum may act as graphitizer or be quite neutral. Boron is a graphitizer in traces; more is a stabilizer, the reversion occurring at about the same concentration as the change in effect on hardenability of steel. 5 ref.

14-374. **Dust Removal at Belt Transfer Points.** C. C. Hermann. *Foundry,* v. 73, Dec. '45, pp. 107, 226, 228.

Considers transfer belt hood design from gray iron and steel foundry angle.

14-375. **Effective Use of Cereal Core Binders.** A. E. DeClercq and Tom Barlow. *Foundry,* v. 73, Dec. '45, pp. 108-109, 192-193, 195-196, 200, 202, 204, 206, 208, 210.

Discussion of effective utilization of corn flour by foundry industry. Careful control of amount of binder, percentage of moisture, correct mulling time, and optimum combinations of baking time and temperature will insure the coremaker greatest possible advantage.

14-376. **Precision Founding.** Francis Dittmar. *Iron Age,* v. 156, Nov. 22, '45, pp. 68-71.

Describes setup whereby a vacuum is applied while metal is being poured to secure elimination of gases, and how vacuum method can be joined to centrifugal casting to procure a metal having much denseness and soundness.

14-377. **Continuous Casting.** Leslie H. Day. *Metal Treatment,* v. 12, Autumn, '45, pp. 193-199.

Describes Merle method of continuous casting, explaining principles employed, and necessary appliances for casting slabs, billets, sections and shapes, and bimetallic castings. Details of machines for continuously producing strip, sheet and bar, plain or composite also given. Treatment of molten metal to remove suspended impurities discussed. 6 ref.

14-378. **Fluxing Molten Aluminum With Dry Nitrogen.** P. M. Hulme. *Materials & Methods,* v. 22, Nov. '45, pp. 1435-1438.

Effect of gas fluxing; chlorine methods used; reverberatory furnaces; nitrogen aids alloying; fluxing scrap aluminum. 2 ref.

14-379. **Die Casting.** Herbert Chase. *Materials & Methods,* v. 22, Nov. '45, pp. 1441-1452.

Methods of production; types of alloys used; advantages and limitations; design principles; present and future applications.

14-380. **Quality Control of High Tensile Steel Castings.** *Iron Age,* v. 156, Nov. 29, '45, pp. 52-55.

Two main factors in controlling quality of high tensile steel for castings are aluminum additions to control grain size and sulphide distribution, and accurate temperature measurements. 8 ref.

14-381. **The Gating and Feeding of Steel Castings.** S. T. Jazwinski, E. D. Wells and S. L. Finch. *Foundry Trade Journal,* v. 77, Nov. 15, '45, pp. 221-228.

Higher yield of sound castings results from application of science to gating problems.

14-382. **Control of Porosity in Aluminum Alloy Pistons.** *Light Metal Age,* v. 3. Nov. '45, pp. 16-20, 38-39.

Describes investigations of a large aluminum foundry into various factors contributing to porosity in aluminum castings. Based upon findings, recommendations are made as to foundry practice to eliminate causes. 2 ref.

14-383. **Fluid Performance of Magnesium.** L. A. Carapella and W. E. Shaw. *Light Metal Age,* v. 3, Nov. '45, pp. 35-36, 48.

Discusses effect of different alloying constituents, time, temperature and other factors upon the castability of magnesium alloys; table of relative castability of magnesium alloys. 7 ref.

SECTION XV

SALVAGE AND SECONDARY METALS

15-1. **The Scrap Industry Anticipates No Trouble in Meeting Requirements of Steel Mills and Foundries.** Edwin C. Barringer. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 77-78.

Inventories of home scrap and of pig iron remained fairly constant, but those of purchased scrap showed a progressive deterioration. Battlefield scrap; termination scrap; disposal of battlefield scrap.

15-2. **Effect of Alloying Elements on Aluminum Casting Alloys.** Walter Bonsack. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 789-813.

Shows the effect of minor alloying elements which cannot be removed from scrap metal commercially, but which, when diluted and blended properly have a place in aluminum alloys. Gives results obtained with a new series of alloys developed in the aluminum-magnesium-zinc type of alloy.

15-3. **Testing Brass Turnings for Silicon Contamination.** M. R. Berke. *Metal Progress,* v. 47, Feb. '45, p. 272.

Method to determine whether red brass or tin-bronze turnings, purchased for remelting into alloy ingots, are contaminated by silicon-bronze turnings.

15-4. **The Reclamation of Swarf.** *Machinery* (London), v. 66,, Jan. 18, '45, pp. 57-60.

By careful separation and selection, several thousand tons of aluminum scrap are made available to the aircraft industry.

15-5. **Salvaging High-Speed Steel Scrap.** Eric Simons. *Steel,* v. 116, Feb. 19, '45, pp. 140, 166.

Shortages of materials and tools in England re-emphasize importance of conservation and reclamation. Greater care in use of high-speed steel, diminution of sizes and use of valuable scrap as inserts brazed to mild steel pads and for teeth in slotting side and face cutters are found effective.

15-6. **Scrap Melting Procedure Saves Alloys.** Victor E. Zang. *Foundry,* v. 73, March '45, pp. 92-93, 198.

Unitcast Corp. reviews alloy program for the year of 1944 as a supplement to the October report of the

Ferrous Foundry Advisory Committee to the War Production Board.

15-7. **Iron and Steel Scrap.** Harold E. Carmony. *Mining Congress Journal,* v. 31, Feb. '45, pp. 118-119.
Iron and steel scrap industry continues laudable performance.

15-8. **Nonferrous Scrap and Secondary Metals.** F. H. Wright. *Mining Congress Journal,* v. 31, Feb. '45, pp. 120-122.
The level of activity in the non-ferrous secondary metals industry in 1944 was maintained close to the high rate achieved in 1943, with immense quantities of new scrap originating in industrial plants moving swiftly back into the stream of usable raw materials.

15-9. **Cyanide Removal From Metal Finishing Wastes.** Francis S. Friel and Gordon J. Wiest. *Water Works and Sewerage,* v. 92, March '45, pp. 97-98.
Method of treatment involving chlorination for destruction of the cyanides. 7 ref.

15-10. **Reclaiming Cracked Castings — an Electrolytic Process.** *Production & Engineering Bulletin,* v. 3, no. 23, Oct. '44, pp. 454-455. British Cast Iron Research Association *Bulletin and Foundry Abstracts,* v. 7, Jan. '45, p. 217.
Describes the repair of cracked castings by electrodeposition of copper.

15-11. **Production of Steel From Battlefield Scrap.** *Steel,* v. 116, April 2, '45, pp. 105, 146.
Battlefield and arsenal scrap has no deleterious effect on finished steel, provided problem is recognized as one of proper scrap segregation. Chromium content can be reduced through slag removal in the open-hearth and nickel and molybdenum through dilution with carbon steel scrap.

15-12. **Chemical Control.** F. F. Pollak and F. Pellowe. *Metal Industry,* v. 66, April 6, '45, pp. 210-212.
During the war there has been a considerable lack of virgin metal and a superabundance of swarf. It has been found possible by careful control to cast bars from all-swarf mixtures of such quality that they could be used in place of extruded rods. 18 ref.

15-13. **Secondary Aluminum Ingot Smelters Favor Disposal of Government Surplus by Negotiation.** J. B. Neiman. *Metals,* v. 15, April '45, pp. 9-12.
Prefer that sales method over others; industry against government conversion of scrap aluminum stockpile into ingots.

15-14. **Salvaging Aluminum Castings.** *Modern Metals,* v. 1, May '45, pp. 13-15.
Value of salvaging light metal castings has been proven during this war. On return to peacetime production, this knowledge will result in substantial savings both to the producer and manufacturer.

15-15. **Britain Guards Against Waste.** W. J. Hargest. *American Machinist,* v. 89, May 10, '45, pp. 126-129.

Typical of large aircraft engine plants Rolls-Royce has installed centralized oil and chip salvage facilities. Chip handling is conveyorized and oil reclamation is operated from a single panel.

15-16. **Recovery of Copper From Waste Waters.** B. A. Southgate and J. Grindley. *Industrial Chemist,* v. 21, March '45, pp. 144-152.

Metal industry problem; diverse conditions; loss of copper; spent pickle liquor; waste washing water; laboratory experiments; observations; sludge removal; horizontal flow tanks; experiments with full-scale plant; iron in effluent; value of recovered copper.

15-17. **Secondary Aluminum Alloys.** *Metal Industry,* v. 66, March 30, '45, p. 201.

Secondary aluminum alloys containing 4 to 12% Cu with a high amount of impurities: 0.8 to 3.3% Fe, 0.25 to 1.5% Si, 0.3 to 1.5% Zn, and 1 to 10% Pb, Mn Mg, to determine the effect of small amounts of cerium showed improved mechanical properties and finer grain with cerium additions.

15-18. **The Reclamation of Aluminum Alloys in an Aero-Engine Foundry.** A. H. Rathbone. *Foundry Trade Journal,* v. 75, April 12, '45, pp. 299-302; April 19, '45, pp. 315-318.

Utilization of secondary alloys dictated by wartime conditions.

15-19. **Scrap Aluminum Converted to New Metal.** *Automotive Industries,* v. 92, May 15, '45, p. 56.

Scrap aluminum converted into new aluminum. Process centers around way for returning the scrap aluminum to the Bayer Process.

15-20. **The Recovery of Hard Metal from Grinding Dust and Grinding Sludge.** E. Dinglinger. *Werkstattstechnik der Betrieb,* v. 37/22, no. 5, May '43, pp. 181-183. *Engineers' Digest* (American Edition), v. 2, May '45, pp. 221-223.

Hard metal scrap occurs as chippings in the manufacture of the tools, when cracked tips are detached; when all remnants or odd pieces of used tools are broken up. Recommendations for the collection and utilization of hard metal scrap given. Recovery of tungsten from grindings can be substantially easier and more economically planned.

15-21. **New Aluminum From Old.** *Aluminum News-Letter,* June '45, p. 2.

Scrap aluminum converted into new aluminum by means of a special chemical process.

15-22. **Improved Methods of Utilizing Tin Plate Discard.** C. C. Downie. *Sheet Metal Industries,* v. 21, May '45, pp. 821-823.

Initial handling and soldering; cutting the stack; combined sawing and filing machine used.

15-23. **Charge Components for Wrought Aluminum Alloys.** Owen Lee Mitchell. *Light Metal Age,* v. 3, June '45, pp. 16-19, 30.

Various charge components used in the production of wrought aluminum alloys are discussed, so that a clear concise picture of the scrap situation can be obtained. Explains limitations on use of scrap.

15-24. **Selective Salvage.** H. C. Chetwood-Aiken. *Metal Industry,* v. 66, June 8, '45, p. 360.

Applications of rejected materials in other industries.

15-25. **Repair of Steel Castings.** *Foundry,* v. 73, July '45, pp. 92-93, 250-253.

Report covers recommendations for a proposed Engineering Bulletin and Suggested Shop Procedure applying to repair of steel castings.

15-26. **Problems Connected with Reclamation of Worn Parts by the Metal-Spraying Process.** W. E. Ballard. Institution of Mechanical Engineers *Journal,* v. 152, June '45, pp. 4-7.

Describes certain matters of interest to engineers in connection with this form of salvage. Metal spraying is being used commercially to a very large and increasing extent for reclamation work. Answers the following questions: Is metal spraying a suitable method of reclamation? If so, how must the work be prepared for spraying? What method of spraying and which metal should be used? What finish is necessary? 9 ref.

15-27. **Repair of Malleable Iron Castings.** *Foundry,* v. 73, Aug. '45, pp. 111, 224, 226, 228, 230.

Repair of imperfections in ferrous castings; procedure accompanies a proposed Engineering Bulletin instructing prime contractors on information to be furnished in seeking approval of repair practices, and is intended as a general guide as to types and extent of repairs that will be considered.

15-28. **Repair of Defective Gray-Iron Castings.** S. H. Brams. *Iron Age,* v. 156, Aug. 9, '45, pp. 74-75.

Cold welding; repair by brazing.

15-29. **Reconversion Bulletin, No. 1.** *Metals & Alloys,* v. 22, July '45, pp. 110-122.

Planning and preparation; disposing of government-owned equipment; purchasing government-owned equipment for reconversion; reconverting the equipment; storage of machine tools (not government-owned).

15-30. **Remelting and Reclaiming Aluminum Scrap.** Rolland R. LaPelle. *Aluminum & Magnesium,* v. 1, July '45, pp. 21-24.

Outlines considerations involved in the handling and reclaiming of aluminum scrap material, and the treatment required to turn these materials into first quality aluminum alloy pig which can be used for highly stressed and critical items.

15-31. **Secondary Aluminum.** R. R. Caizley. *Engineering Materials and International Power Review,* v. 3, April '45, pp. 73-77.

Main considerations affecting its future use are: Price, available supplies, fabrication capacity. Development; specification-casting alloys; D.T.D. 424; D.T.D. 428; L.A.C. 10; LAC 112A; LAC 113B; L.8; L.24 ("Y" Alloy); L.33; D.T.D. 478; D.T.D. 479.

15-32. **Steel Discard.** A. G. Arend. *Iron & Steel,* v. 18, Sept. '45, p. 415.
Much of the scrap shortly to come on the market, now that the need for war products has ceased, will be in a form needing only a moderate amount of work to render it usable in another shape. A prewar mill arranged for this work described.

15-33. **Scrapping, Storing and Salvaging War Tools.** Jack L. McGraw. *Modern Industrial Press,* v. 7, Sept. '45, p. 36.
Determining tools on hand; storing; salvaging.

15-34. **Navy Recovers Aluminum From Aircraft.** Donald L. Colwell. *Modern Metals,* v. 1, Oct. '45, pp. 8-12.
Disposal policy and technique for the billion or more pounds of aluminum from obsolete or "war weary" military aircraft has been subject to much speculation. Review of the over-all picture and the most logical solution of that problem.

15-35. **Turret Lathe Replaces Hand Tools in Deburring Steel Bushings.** *American Machinist,* v. 89, Oct. 11, '45, pp. 106-107.
Broken, four-flute end mills are salvaged and ground into V-notch cutters for the dual chamfering operations on the cut-off ends.

15-36. **Inexpensive Tube Benders Made From Salvaged Materials.** Andrew Brown. *American Machinist,* v. 89, Oct. 11, '45, pp. 108-109.
Non-strategic materials are used in their construction.

15-37. **Magnesium Alloy Scrap.** A. G. Arend. *Metallurgia,* v. 32, Sept. '45, pp. 200-202.
From the large tonnages of scrap magnesium alloys which will become available it is suggested that in some cases direct fabrication methods may be applied in which welding and cutting operations will be employed.

15-38. **Bronze.** *Tin and Its Uses,* no. 16, Sept. '45, pp. 8-9.
New methods of production permit the highest qualities of bronze to be made from 100% scrap melts. No technical information is given.

15-39. **Pneumatic Scrap Collection.** *Steel,* v. 117, Nov. 12, '45, pp. 121, 178.
Higher production, stress on segregation, improved economy in oil reclamation and reduction in handling hazards are contributing factors. System outlined.

15-40. **The Influence of Scrap Aluminum on the Post-War Market.** N. H. Engle. *Aluminum & Magnesium,* v. 2, Nov. '45, pp. 18-21, 27.
Economic factors; technological factors.

15-41. **Calumet & Hecla Recovers Scrap Copper.** *Engineering & Mining Journal,* v. 146, Oct. '45, p. 89.
General reference to the ammonia leaching process.

15-42. Oxygen Lancing Facilitates Scrapping of Huge Castings. *Machinery,* v. 52, Nov. '45, p. 156.

Since the oxygen lance can sever metal of practically any thickness, it is an effective "trouble-shooter" for metal-disposal problems.

15-43. Babbitt Scrap. P. G. Forrester and J. W. Price. *Metal Industry,* v. 67, Nov. 2, '45, p. 277.

Removal of zinc from tin and tin-base alloys. 6 ref.

15-44. Copper Refinery May Be Erected in England for Treating Scrap and Residual Materials. L. H. Tarring. *Metals,* v. 16, Nov. '45, pp. 15-16.

Plan is to move plant and equipment from Germany to U. K.; outlook for resumption of trading on exchange not bright.

15-45. Salvaging Forged Alloy Steel Rolls. H. L. Watson. *Iron & Steel Engineer,* v. 22, Dec. '45, pp. 55-61.

In many cases, mills can reduce operating costs by salvaging "worn-out" rolls. Managements might well select mills which will permit the conversion of worn rolls from one mill to further use in other mills.

SECTION XVI

FURNACES AND FUELS

16-1. **Blast Furnace Tuyeres.** J. B. Fortune. *Iron & Steel,* v. 17, Dec. '44, pp. 704-708.

Tuyere life depends on a number of factors of which the principal are the quality of the metal used in their construction and the suitability of their design for the prevailing conditions. Given good metal and good design there are still various causes of tuyere failure: Normal wear, stoppage of cooling water circulation, dirty water and poor water distribution. Their effects and the means of overcoming them discussed. Abnormalities in furnace operation have led to variations in tuyere design, and examples of these, including dipping and non-radial blowing tuyeres, given.

16-2. **Modern Trends in Blast Furnace Design.** Frank Janecek. *Iron & Steel Engineer,* v. 21, Dec. '44. pp. 37-40, 73.

Since World War I, the number of blast furnaces in the United States has steadily decreased while their size steadily increased. Performance of the large modern units would indicate that even larger furnaces can be operated successfully.

16-3. **A Producer Gas Fired Furnace Installation.** *Wire Industry,* v. 2, Dec. '44, pp. 611-612.

Installation for the heat treatment of bars and sections, the plant consisting of four heat treatment furnaces, two oil quenching tanks, one water quenching tank, four loading platforms and an electrically-operated wedge-type high speed charging machine. Designed for a continuous output in either hardened and tempered, annealed or normalized conditions, of alloy and special steel bar and section stock.

16-4. **Automatic Ovens.** *Steel,* v. 116, Jan. 15, '45, p. 92.

Complete furnace cycle, from heating to quenching, is provided by units incorporating several unusual handling features.

16-5. **Heat Flow.** R. Jackson, R. J. Sarjant, J. B. Wagstaff, N. R. Eyres, D. R. Hartree, and J. Ingham. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 786-793.

Technique of calculation, and its practical application.

16-6. **Blast-Furnace Practice.** T. P. Colclough. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 799-803.
Considerations of changes necessary for fuel reduction.

16-7. **New Design of Horizontal-Type Foundry Oven for Baking Cores.** *Industrial Heating,* v. 12, Jan. '45, pp. 98, 103-104.
Has four levels of horizontal core travel.

16-8. **Modern Blast Furnace Design and Operation, II.** James Dale. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 84-89.
Details of construction. (Abstract of paper read before the West of Scotland Iron and Steel Institute.)

16-9. **Coreless Induction Furnace Practice.** Karl Boer. (*Elektrotechnische Zeitschrift,* v. 65, no. 19/20, May 17, '44, pp. 185-189.). *Engineers' Digest* (American Edition), v. 2, Jan. '45, pp. 44-46.
Operation of a coreless induction furnace; circuits for coreless induction furnaces; electrical measurements of the furnace plant.

16-10. **Queen City Steel Treating Company Plant Features Modernized Production Set-up.** *Industrial Heating,* v. 12, Jan. '45, pp. 129-132, 134, 136, 138-139, 141.
Facilities available for electric-furnace copper brazing on a production basis; describes the various furnaces and other equipment installed.

16-11. **Foundry Coke: A Critical Study.** B. P. Mulcahy. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 819-845.
Explanation of the chemical reactions taking place during the combustion of coke in a cupola and how the reactions and their locations vary with air pressure, size of coke and make-up of the charge. Recommendations regarding the cupola air, and size and character of the material charged. Describes the manufacture of a by-product foundry coke and its characteristics. 8 ref.

16-12. **Cokes Utah Coal in Pacific Coast By-Product Ovens.** G. Eldridge Stedman. *Steel,* v. 116, Jan. 29, '45, pp. 84, 86, 88, 91.
Low-temperature char, petroleum coke and tamping of coal charge in oven are under investigation as a means toward effecting further economies. Ovens are operated on 18-hr. coking time. Full line of by-products recovered in modern equipped plant.

16-13. **Miniature Smelting.** *Iron Age,* v. 155, Feb. 1, '45 p. 57.
One-eighth scale working model described.

16-14. **New Research Data Concerning the Ash Deposits on Heated Boiler Surfaces.** Arthur Zinza. *VDI Zeitschrift,* v. 88, no. 13-14, April 1, '44, pp. 171-178.
When high ash fuels were used in a large boiler installation, an extensive ash accumulation was discovered on the heated surfaces. Such accumulation could

not be avoided by the modification of combustion chambers. This fact induced the investigation of ash constituents and led to the plotting of phase diagrams for ash between $CaSO_4$ and the other ash constituents. Further research on the basis of such diagrams may possibly indicate a remedy.

16-15. **Modern Blast Furnace Design and Operation.** James Dale. *Blast Furnace & Steel Plant,* v. 33, Feb. '45, pp. 232-236, 278.

Distribution of the raw materials in the blast furnace. (Abstract of paper read before the West of Scotland Iron & Steel Institute.)

16-16. **Use of Power for Fast Melting.** N. J. Roberts. *Blast Furnace & Steel Plant,* v. 33, Feb. '45, pp. 237-240.

Characteristics of the electrical circuit of the arc furnace discussed by metallurgists and others who are responsible for the actual production of steel in the electric furnace. (Presented at the Electric Furnace Steel Committee, American Institute of Mining & Metallurgical Engineers, Oct. 5-6, 1944).

16-17. **Tray Improvements Brought About by Wartime Use of Pusher Furnaces.** Joseph Sammon. *American Machinist,* v. 89, Jan. 4, '45, pp. 90-93.

Better quality of heat-treated work and a programmed method of work loading are advantages of trays and tray fixtures designed specifically for the conditions in a given plant.

16-18. **Developments in Heating in 1944.** *Steel Processing,* v. 31, Jan. '45, pp. 47-48.

Roller hearth furnaces; infra-red ovens; elevator furnaces; small heating units; electronic heaters.

16-19. **Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces.** Wallace G. Imhoff. *Industrial Gas,* v. 23, Jan. '45, pp. 16-17, 29-31.

Galvanizing furnaces, gas-fired.

16-20. **Fixtures Extend Usefulness of Trays for Pusher Furnaces.** Joseph Sammon. *American Machinist,* v. 89, Feb. 1, '45, pp. 92-93.

When a change takes place in a product, 90% of the trays on hand can be kept in service by purchasing new tray fixtures.

16-21. **Prevention of Sludge Deposits.** R. W. Mitchell. *Steel,* v. 116, Feb. 12, '45, pp. 106, 152.

In fuel oil storage tanks use of dispersing agents permits more efficient furnace operation.

16-22. **Recent Applications in Radiant Gas Heating.** A. L. Roberts. *Industrial Gas,* v. 23, Feb. '45, pp. 22, 35-36.

How radiation and convection differ; principles of infra-red process; possibilities of selective absorption.

16-23. **The Performance of Larger Hot Blast Stoves.** B. B. Frost. *Iron and Steel Engineer,* v. 22, Feb. '45, pp. 64-69, 79.

Blast heating ability is determined by the heat storage and transfer capacity of one stove and not by the total of the group; for normal basic iron production, two properly designed stoves in continuous operation will insure reasonable blast temperature.

16-24. **New Open-Hearth Furnaces at Homestead.** H. J. Pugsley. *Iron and Steel Engineers,* v. 22, Feb. '45, pp. 89-97.

This modern plant includes the latest features designed to aid in efficient operation; more than a year of operating experience has borne out the forethought put into the planning.

16-25. **Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces. Part XXV.** Wallace G. Imhoff. *Industrial Gas,* v. 23, Feb. '45, pp. 18-19, 33-35.

16-26. **Physical Control Methods in the Steel Industry.** W. Barr and T. F. Pearson. *Journal of Scientific Instruments,* v. 22, Jan. '45, pp. 1-5.

Describes some of the methods of control (involving physical principles) which are common to a large steelworks, to indicate their significance and some of the difficulties still outstanding. 7 ref.

16-27. **Rotating Hearth Furnaces.** A. C. Kramer. *Industrial Heating,* v. 12, Feb. '45, pp. 248, 250, 252.

Due to the wide operating temperature range, the ease of operation, labor saving, temperature uniformity and the ability to heat a wide variation in size of materials, this installation has won favor over other conventionally designed furnaces.

16-28. **Unique Firing Method Features Operation of Cover-Type Furnaces.** Oscar Olson. *Industrial Heating,* v. 12, Feb. '45, pp. 254, 256, 258, 260, 266.

Burners of unique design are a feature of a type of cover furnace which has been successfully applied in the recent past to the heat treatment of steel in wire, rod, strip, coil and sheet form, in such operations as normalizing, annealing and spheroidizing.

16-29. **Furnace Operation and Control.** Roy S. Arrandale. *Glass Industry,* v. 26, March '45, pp. 128-130, 147.

Furnace operation. Producer gas-fired; oil-fired; natural gas; effect of composition.

16-30. **U. S., European, Continuous Enameling Furnaces Compared.** Paul A. Huppert. *Ceramic Industry,* v. 44, March '45, pp. 55-56, 58.

Specific information about the recuperative system in European construction. 19 ref.

16-31. **The Electric Rocking Resistor Furnace.** C. S. Johnson. *Foundry Trade Journal,* v. 75, Jan. 11, '45, pp. 31-33.

Attractive features of this type of equipment.

16-32. **Arc Furnace Regulators.** R. A. Geiselman and J. E. Reilly. *Steel,* v. 116, March 19, '45, pp. 136, 139, 170, 172.

Control of generator voltage affords variation through full speed range of motor operating the elec-

trode hoist with a marked reduction in the breakage of electrodes. Electronic regulation and control of electrode motors provide sensitivity and speed of response.

16-33. **Symposium on Measurement of Heat Absorption in Furnaces.** *Industrial Heating,* v. 12, March '45, pp. 402, 404, 406, 408.

Temperature measurement of a steel slab under normal steel plant operation; test results.

16-34. **Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces.** Wallace G. Imhoff. *Industrial Gas,* v. 23, March '45, pp. 20-21, 32, 34.

Galvanizing furnaces—gas-fired. Eclipse Fuel Engineering Co. furnaces.

16-35. **Diesel Gas Engine Cuts Fuel Consumption 25 Per Cent.** Ralph L. Boyer. *Iron Age,* v. 155, March 29, '45, pp. 61, 112.

Development which permits use of either gas or oil as fuel without any electrical sparking device, and which cuts fuel consumption of gas engines from 20 to 25%.

16-36. **Electric Furnace Capacity.** John McBroom. *Foundry,* v. 73, April '45, pp. 115, 235-236.

Method which determines the size shell for any size heat.

16-37. **Application of Gas Burner Equipment to Existing Furnaces.** A. H. Koch. *Steel Processing,* v. 31, March '45, pp. 179-182.

Radiation losses; heat removed by charge; heat input required; burner capacity.

16-38. **Foundry Fuel.** W. J. Driscoll. *Iron and Steel,* v. 18, March '45, pp. 75-80.

How a simple analysis of the fuel input to a foundry, and of the way in which the heat contained in that fuel is expended, may lead to appreciable fuel economies provided that the implications of the results of the analysis are understood and acted upon.

16-39. **Flues for Modern Open-hearth Furnaces.** A. G. Arend. *British Steelmaker,* v. 11, March '45, pp. 128-130.

Dust; corners and bends; specialized metals required.

16-40. **Some Factors in Design of Pulverized Coal Furnaces.** *Combustion,* v. 16, March '45, p. 49.

Furnace shape; early steps in water cooling; types of firing.

16-41. **Anthracite Additions to Coke Oven Coal Mixtures for the Production of Blast Furnace Coke.** D. L. Newkirk. *Blast Furnace & Steel Plant,* v. 33, April '45, pp. 461-463.

Anthracite additions to coke oven coal mixtures resulted in improvement of foundry coke.

16-42. **Uses of Gases in the Foundry.** Harold Haynes. *Foundry Trade Journal,* v. 75, March 15, '45, pp. 209-213.

Utilizing town or producer gas for heating and drying.

16-43. **The Scope and Limitations of Radiant Heating in Drying Processes.** H. Silman. *Foundry Trade Journal,* v. 75, March 15, '45, pp. 217-221.

Methods which will find an important place in mass-production schemes. 9 ref.

16-44. **Non-Ferrous Metal Melting, II.** Davidlee Von Ludwig. *Industrial Gas,* v. 23, April '45, pp. 11-14, 32.

Comparison of test bar castings made in oil and gas-fired crucible furnaces.

16-45. **Application of Burner Equipment to Furnaces.** A. H. Koch. *Industrial Gas,* v. 23, April '45, pp. 15-16, 31.

Availability of fuel and equipment will take second place to production costs during and after the reconversion period. Careful study of heat treating production costs undoubtedly will bring about the conversion of many existing furnaces to gas fuel.

16-46. **Induction Burners for Blast Furnace Gas, Producer Gas and Coke Oven Gas.** G. Neumann. *Archiv fur das Eisenhuttenwesen,* v. 17, May-June '44, pp. 237-246. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 120-A.

Induction gas burners have previously been described by W. Heiligenstaedt (see Iron and Steel Institute *Journal,* 1943, no. II, p. 35-A). In the present mathematical treatise curves and equations are developed showing the relationship between gas and air pressure at the burner and the furnace pressure, and examples are given of their applications to determine the dimensions of burners to meet certain rquirements when the fuel consists of blast furnace gas, producer gas or coke oven gas mixed with cold air.

16-47. **Gas Turbines for Blast Furnace Blowers.** Paul R. Sidler. *Iron & Steel Engineer,* v. 22, April '45, pp. 35-45.

Gas turbines offer certain advantages without sacrificing reliability; blast furnace operators might well consider these advantages in planning replacement or extension of blowing equipment. 4 ref.

16-48. **Industrial Furnaces.** R. J. Sarjant. *Iron & Steel,* v. 18, April '45, pp. 128-132.

Discusses, with relation to furnaces, the questions of the availability and economics of fuels, improvements in furnace design, smoke destruction, and the importance of the further education of industry to the necessity for still greater efficiency in the use of fuel, with its concomitant reduction in atmospheric pollution.

16-49. **An Analysis of Open-Hearth Combustion.** Gilbert E. Seil. *Steel,* v. 116, May 14, '45, pp. 124, 172, 176, 178, 180.

Multiple burners firing crosswise over open-hearth bath affords increased rate of heat transfer and more tons of steel per hour. Preheated air is supplied either by checker chambers of reversible furnace or by recuperator of one-way furnace.

16-50. Reversing Regenerative Furnaces. J. R. Green and J. P. Vollrath. *Iron & Steel Engineer,* v. 22, April '45, pp. 67-77, 81.

The use of reversal control, either signaling or fully automatic, on regenerative furnaces will result in more uniform operation, increased output and decreased refractory maintenance.

16-51. World's Largest Rotary-Hearth Furnace Heats Billets for Piercing Mill. John H. Loux. *Industrial Heating,* v. 12, May '45, pp. 791-792, 794, 796, 798, 800, 761.

Furnace dimensions and burner equipment; hearth construction; shell design; control; flues; uniformity of heating; operating advantages; charging and discharging machines.

16-52. Combustion, Temperature and Quality Control in Open-Hearth Furnaces. B. B. Rosenbaum. *Industrial Heating,* v. 12, May '45, pp. 802, 804, 806.

Summarizes the discussions on combustion and temperature control in open-hearth furnaces, and the metallurgy and quality of open-hearth steel, which formed part of the program of the recent Philadelphia Section meeting of the National Open Hearth Committee of the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

16-53. Open-Hearth Furnace Operation and Maintenance. *Industrial Heating,* v. 12, May '45, pp. 842, 844, 846, 848.

Life of refractories; handling methods; mechanical slag removal methods; cleaning checker flues; hot metal mixers; use of sinter, nodules and briquettes.

16-54. Development of the Industrial Vacuum-Melting Furnace. Werner Messenbruch and Karl Schichtel. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 127-130.

16-55. The Flow of Air and Gas in Vertical Flue Coke Ovens. George A. Davis. *Blast Furnace and Steel Plant,* v. 33, May '45, pp. 568-578.

Zones of distribution; other types; regenerator distribution; distribution in the vertical flue system; lean gas underfiring; formulas used in distribution design.

16-56. Modern Blast Furnace Design and Operation, Part V. James Dale. *Blast Furnace and Steel Plant,* v. 33, May '45, pp. 579-581, 614.

Rate of blowing a blast furnace, to secure maximum economic efficiency. (West of Scotland Iron and Steel Institute.)

16-57. Some Operating Experiences With High Pressure Land Boilers. R. Carstairs, P. Hamer and B. M. Thornton. *Blast Furnace and Steel Plant,* v. 33, May '45, pp. 586, 588-590.

High pressure boilers; economizers; evaporation bank.

16-58. How Will You Choose Your Drying Oven? Hubert Glatte. *Industrial Gas,* v. 23, May '45, pp. 14-17, 31-32, 34.

Relationship of inductive heating to infra-red electric lamp heating is so remote that, except for two common characteristics, they are strangers. They both use electricity as their source of energy and they are both developments stemming from originally troublesome features of certain electric equipment. Cost and efficiency of equipment; cost of operation; control of temperature; safety; quality of production; capacity of equipment.

16-59. **Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces, XXVIII.** Wallace G. Imhoff. *Industrial Gas,* v. 23, May '45, pp. 20, 22, 29-30.

Galvanizing furnaces, gas-fired. The Selas Co. galvanizing furnace. 8 ref.

16-60. **Limitations of Dielectric Heating.** Carl J. Madsen. *Aero Digest,* v. 49, June 1, '45, pp. 112, 240.

Concerned with only dielectric heating—heating of materials by a varying electric field—and reviews the major limitations that prevent universal application.

16-61. **Selecting Gas Immersion Tubes.** *Steel,* v. 116, June 4, '45, pp. 108-110, 146, 148.

Data on design and applications of immersion tubes suitable for industrial heating purposes. Presented along with complete information on determining heat output and other considerations of thermal efficiency.

16-62. **Vacuum System Removes Dust from Open-Hearth Flues.** *Steel,* v. 116, June 4, '45, p. 125.

Dirt from open-hearth cellars is conveyed by suction through a steel collector main to a receiving tank which empties either into a box or gondola car. Unit can be transferred from one open-hearth to another or can be installed permanently. Savings in man-hours range from 50 to 70%, based on early installations. Steam consumption varies from 1800 to 3000 lb. per hr. at 125 lb. nozzle pressure.

16-63. **A Method for Determining Electric Furnace Capacity.** John McBroom. *Steel,* v. 116, May 28, '45, pp. 128, 155.

Method to determine the size shell for any size heat.

16-64. **Infra-Red Versus Convection Heating.** Charles C. Eeles. American Gas Association *Monthly,* v. 27, June '45, pp. 281-286.

Heat transfer methods; finish types and characteristics; infra-red characteristics; heat intensity; convection characteristics; present equipment; worries are legion; future probabilities; rapid heating aim; convection ovens adaptable.

16-65. **Four-Zone Conveyor Oven.** C. A. Litzler. *Steel,* v. 116, June 11, '45, pp. 138, 141-142, 186, 188, 190.

Affords dust-free finishing of ordnance items and civilian goods, provides for minimum handling of work, obtains maximum fuel economy by full reheating and recirculating system, handles wide range of temperatures and baking times.

16-66. **Temperature Distribution and Tube Expansion in Radiant Heating Panels.** R. G. Vanderweil. *Heating and Ventilating,* v. 42, June '45, pp. 69-74.

Flow of heat throughout the panel and the problem of expansion of tubes.

16-67. **Charging Electric Steel and Other Furnaces.** *Foundry Trade Journal,* v. 76, May 17, '45, pp. 54, 55.

Minimum turning radius; choice of power; the charging bar.

16-68. **Use of Blast-Furnace and Coke-Oven Gas in Steel-Plant Furnaces.** *Industrial Heating,* v. 12, June '45, pp. 984, 986.

Article summarizes two of the prepared papers presented at Symposium of A.I.S.E., describing current practices in two plants.

16-69. **Scaling Properties of Steels in Furnace Atmospheres.** A. Preece and R. V. Riley. *Steel Processing,* v. 31, May '45, pp. 311-315.

Results obtained in a survey of the scaling characteristics of a selection of steels in furnace atmospheres at 1150° C.

16-70. **Mercury Arc Heating Frequency Converter.** S. R. Durand. *Electronic Industries,* v. 4, June '45, pp. 74-78, 150, 155.

Mercury pool unit supplying 100 or more kilowatts at several thousand cycles for induction heating and melting.

16-71. **Malleable Cast Iron.** L. S. Wilcoxson and D. F. Sawtelle. *Iron and Steel,* v. 18, May '45, pp. 177-180.

Pulverized coal firing of annealing furnaces. (American Foundrymen's Association.)

16-72. **Auxiliary Heating in Siemens-Martin Furnaces.** Gottfried Prieur. *Stahl und Eisen,* v. 64, Jan. 13, '44, pp. 21-24.

In the performance of Siemens-Martin furnaces with and without auxiliary heating in the recuperator, at the same heat consumption, an increase of at least 15% in output was obtained with auxiliary heat. This small increase in output can probably be raised considerably.

16-73. **Design and Construction of Power Plant for Steel Mills.** Karl Schröder. *Stahl und Eisen,* v. 64, Jan. 13, '44, pp. 24-29.

16-74. **Theory of Operating Blast Furnaces at High Top Pressures.** T. L. Joseph. *Blast Furnace & Steel Plant,* v. 33, June '45, pp. 699-707.

Problems of counter current flow; pressure drop through the furnace; effect of high top pressures on gas velocities and pressure drop through the furnace; calculated gas velocities with varying blowing rates at 10 lb. top pressure; effect of high top pressure on permissible blast temperatures; irregularities in gas distribution; effect of suspended particles on channeling; effect of suspended particles on the pressure drop

through the bed; effect of high top pressure on the chemistry of the blast furnace process; summary of improvements indicated by a theoretical consideration of high top pressure operation; blast furnace tests on high top pressure operation. 4 ref.

16-75. **Modern Blast Furnace Design and Operation, VI.** James Dale. *Blast Furnace & Steel Plant,* v. 33, June '45, pp. 714-718.

Blowing out of furnaces; installation of tuyeres.

16-76. **Determination of Dust in Blast Furnace Gas.** D. G. Hisley. *Iron & Steel Engineer,* v. 22, June '45, pp. 47-49.

Using sugar as a filtration medium, was developed to eliminate difficulties encountered in the standard thimble method.

16-77. **Coke Oven and Blast Furnace Operation.** J. B. Hill. *Iron & Steel Engineer,* v. 22, June '45, pp. 71-75.

No other unit in a steel plant is influenced so much by so many little, yet important, items as is the blast furnace. Uniformly good practice requires careful attention to these details.

16-78. **Aluminum for America.** *Industrial Gas,* v. 23, June '45, pp. 14-15, 27.

There are three distinct steps in the processing of aluminum—mining, refining, and reduction. Refining process requires large amounts of steam which is produced by gigantic gas-fired boilers.

16-79. **Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces, XXXIX.** Wallace G. Imhoff. *Industrial Gas,* v. 23, June '45, pp. 22-23, 31-34.

Galvanizing furnaces; miscellaneous gas and oil fuels. 12 ref.

16-80. **Coke-Oven Gas.** J. A. Shaw, R. H. Hartigan, and Anna M. Coleman. *Iron & Steel,* v. 18, June '45, pp. 191-192.

Determination of hydrocyanic acid.

16-81. **Electric Steel.** Conrad C. Wissmann. *Iron & Steel,* v. 18, June '45, pp. 197-198, 208.

Notes on the operation of acid lined melting furnaces. (From *Metal Progress.*)

16-82. **Design of Muffles for High Temperature Service.** A. Grodner. *Steel Processing,* v. 31, June '45, pp. 383-384.

Designer and the fabricator of the muffles attempts to solve proper material of construction, ideal shape of the muffle, location and type of the welds to equal the parent metal in strength and ductility over the range of heating and cooling cycle; correct approach to the successful solution of these factors outlined.

16-83. **Pressure Sensitive Control of Furnace Dampers.** *Iron Age,* v. 156, July 12, '45, pp. 61, 130.

Fine adjustment of a furnace damper plays an important part in the maintenance of correct atmospheric conditions within the furnace chamber, and such ad-

justment should be made not in terms of furnace temperature, but in terms of pressure. Damper adjustment is made on the basis of the behavior of the flame of a lighted match held to the spy hole of the furnace door.

16-84. **Consistency and the Cupola**. C. A. Payne. *Foundry Trade Journal,* v. 76, June 14, '45, pp. 133-137.

Outline of factors affecting the control of cupola melting.

16-85. **Tilting Burners Provide Flexible Furnace Performance.** Elno M. Powell. *Combustion,* v. 16, June '45, pp. 36-39.

Control of exit furnace gas temperatures is most important as a means of preventing excessive slag deposits at the entrance to the convection heating surface and to assist in controlling superheat temperature over a wide range in load. How this is effected by tilting tangential burners upward or downward through a total arc of approximately 60° and typical performance curves derived from tests are included.

16-86. **A Completely Automatic Control of Open-Hearth Reversal.** B. M. Larsen and W. E. Shenk. *Metals Technology,* v. 12, June '45, T. P. 1830, 12 pp. Also *Iron & Steel,* v. 18, June '45, pp. 193-196.

Method of reversal control of the open-hearth furnace that obtains in practice those effects considered as essential to a completely automatic control, without appreciable interference with the natural rise and fall in temperature of the regenerative portions of the furnace system.

16-87. **Fuel-Fired Techniques and Their Possibilities.** Frederic O. Hess. *Mechanical Engineering,* v. 67, July '45, pp. 442-444. Also *Industrial Gas,* v. 23, June '45, pp. 11-13, 30-31.

Fuel-fired techniques for high speed heating. Experience has been with gas firing. High speed heating; heating non-ferrous metals; effect of heating on steel; new developments in combustion.

16-88. **Time-Temperature Relationships in Workpieces.** Victor Paschkis. *Mechanical Engineering,* v. 67, July '45, pp. 445-447, 452.

Temperature uniformity within the workpiece; time of exposure; uniformity of rates. 5 ref.

16-89. **High Frequency Induction Heating.** Wesley M Roberds. *Mechanical Engineering,* v. 67, July '45, pp. 448-451.

Radiation method; high frequency induction heating; limiting factors in induction heating; intensity factors; control factors; range of frequencies used; hardening thin shells; effects of frequency.

16-90. **Magnetic Controls for Electric Furnaces.** G. W. Heumann. *Metals & Alloys,* v. 21, June '45, pp. 1637-1642.

Electric furnaces for hardening, annealing, brazing, etc. generally require automatic control, which is usually magnetic control by means of contactors. The

types, performance ratings and applications of such magnetic controls, and the control panels and other accessories used are described.

16-91. **Practical Experiences With the Old-Type Cupola and the New Balanced Blast Cupola.** T. Begg. Institute of Australian Foundrymen: *Australasian Engineer, Science Sheet,* Jan. 7, '45, pp. 2-6. Iron and Steel Institute *Bulletin,* no. 113, May '45, p. 3-A.

Some experiences in the successful operation of a balanced-blast cupola in Australia are related. The melting capacity was 13.3 tons per hr. The temperature of the metal remained consistently high (from 1389 to 1429°C.) from the first tap to the end of the melt. The cupola could be stopped for periods of 30 to 40 min. without any serious drop in the temperature of the metal. The amount of slag which was "fluxed" or "slagged" away from the slag hole was much more with the balanced-blast cupola than with old-type cupolas.

16-92. **The Control of Furnace Dampers.** *Wire Industry,* v. 12, July '45, pp. 361, 363.

New departure.

16-93. **Observations on Gas Flow and Coke Consumption in the Blast Furnace.** Kurt Neustaetter. *Blast Furnace & Steel Plant,* v. 33, July '45, pp. 825-829.

Use of undersize coke in the blast furnace; case of furnace operating poorly with extremely low coke rate; another case where increased furnace efficiency was detrimental to gas flow; observation on dry blast operation with low moisture (1 to 2 grains). 6 ref.

16-94. **Developments in Rotary Hearth Furnaces.** J. H. Loux. *Iron & Steel Engineer,* v. 22, July '45, pp. 52-61.

Why a rotary furnace is used and what its advantages are over other types of furnaces. Five basic applications for rotary hearth furnaces.

16-95. **An Analysis of Open-Hearth Combustion.** Gilbert E. Seil. *British Steelmaker,* v. 11, July '45, pp. 308-312.

Multiple burners firing crosswise over open-hearth bath afford increased rate of heat transfer and more tons of steel per hour. Preheated air is supplied either by checker chambers of reversible furnace or by recuperation of one-way furnace.

16-96. **Immersion Tube Heating With Gas.** Maurice J. Dewey. *Western Metals,* v. 3, July '45, pp. 17-18.

Objectives of immersion heating and the factors involved in acquiring them.

16-97. **New Open-Hearth Furnaces.** H. J. Pugsley. *Instrumentation,* v. 1, no. 5, July-Aug. '45, pp. 3-4.

At Homestead Works of Carnegie-Illinois Steel Corp.; their instrumentation.

16-98. **Open-Hearth Furnace Pressure Control System.** *Instrumentation,* v. 1, July-Aug. '45, p. 19.

Description of the control system; how the control system works; characteristics.

16-99. **Induction and Dielectric Heating Equipment.** *Electronics,* v. 18, Aug. '45, pp. 110-111.

Tabular comparison of technical characteristics and initial cost per kilowatt of output power for commercially available induction and dielectric heating equipment, as reported by manufacturers. Both electronic and non-electronic types are covered.

16-100. **Heating Metal With Cold Coils.** *Production Engineering & Management,* v. 16, Aug. '45, pp. 114, 116.

Induction heating, using high frequency alternating current, makes the metal heat itself. A magnetic field is set up around the coil, which is reversed with each alternation of current. Atomic agitation of metal produces rapid heating.

16-101. **Operation of 4-Ton Open-Hearth.** H. K. Work and W. R. Webb. *Iron Age,* v. 156, Aug. 2, '45, pp. 42-47.

Construction and operating characteristics of J & L's experimental 4-ton open-hearth furnace, which has produced over 2100 tons of plain, medium, and high carbon steels, free-cutting steels, and high alloy steels. (American Institute of Mining & Metallurgical Engineers.)

16-102. **Wright Aeronautical Corp. Uses Large Battery of Nitriding Furnaces.** J. A. Schneider. *Industrial Heating,* v. 12, July '45, pp. 1150, 1152.

Designed to reduce ammonia consumption. Uniformity of hardness and case depth has been improved because of the better operating characteristics of the furnaces. Various views of some of the furnaces and auxiliary equipment are shown.

16-103. **A Completely Automatic Control of Open-Hearth Reversal.** B. M. Larsen and W. E. Shenk. *Industrial Heating,* v. 12, July '45, pp. 1164, 1166, 1168, 1172.

Factors related to the automatic control of open-hearth furnace reversal, and some practical developments in the control of this phase of furnace operation.

16-104. **Modern Melting and Heat Treating Equipment in the Dodge Aluminum Foundry.** *Industrial Heating,* v. 12, July '45, pp. 1189-1190, 1192, 1194-1196, 1198.

Melting furnaces; solution heat treatment oven; aging oven.

16-105. **The Role of Frequency in Industrial Dielectric Heating.** G. W. Scott. *Electrical Engineering,* v. 64, Aug. '45, pp. 558-562.

Equations for development of dielectric heat; variables in heat equation not independent of frequency; limitations of increased frequency; choice of frequency. 3 ref.

16-106. **Design of Induction Heating Coils for Cylindrical Non-Magnetic Loads.** J. T. Vaughan, and J. W. Williamson. *Electrical Engineering,* v. 64, Aug. '45, pp. 587-592.

Equations for the calculation of the required number of coil turns to match a given power source for

solenoidal coils with coaxial cylindrical loads of non-magnetic materials in electromagnetic induction circuits. Correction factor is established for coil shortness. Equations given for power distribution and impedance values. 5 ref.

16-107. **Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces. Part XXX.** Wallace G. Imhoff. *Industrial Gas,* v. 24, July '45, pp. 20-21, 29.

Galvanizing furnaces, electrically heated. 5 ref.

16-108. **Gas Flow and Coke Consumption in the Blast Furnace.** Kurt Neustaetter. *Steel,* v. 117, Aug. 20, '45, pp. 153-154, 157, 184.

Minimum coke consumption and maximum blast furnace production frequently are determined by an orderly gas flow controlled by physical make-up of stock. Observations on the use of dry blast with moisture content of 1 to 2 grains per cu. ft. during summer and winter are presented. 6 ref.

16-109. **Symposium—Disposition of Coke Oven Gas and Blast Furnace Gas.** Paul E. Leiss, R. A. Lytle, Harold C. Cox, H. B. Helm, and L. F. Kopsa. *Iron & Steel Engineer,* v. 22, Aug. '45, pp. 71-80, 91.

At Warren Plant, Republic Steel Corp.; at Johnstown Plant, Bethlehem Steel Co.; at Clairton Works, Carnegie-Illinois Steel Corp.; at Campbell Works, Youngstown Sheet and Tube Co.; at Pittsburgh Works, Jones and Laughlin Steel Corp.

16-110. **Remelt Equipment for Wrought Aluminum Alloys.** Owen Lee Mitchell. *Light Metal Age,* v. 3, Aug. '44, pp. 8-11.

Melting practices for wrought aluminum alloys. Discusses relationship between proper furnace design and product cost, remelting difficulties, and the factors that enter into consideration in the designing of remelting furnaces.

16-111. **Operation of an Experimental Open-Hearth Furnace.** H. K. Work and W. R. Webb. *Steel,* v. 117, Sept. 3, '45, pp. 138, 140, 142, 192, 194, 196. Also *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 959-964.

Continuous one-way fired furnace built with an all-basic roof employs recuperator for preheating air for combustion. Furnace is capable of producing an 8000-lb. ingot. Procedure followed in working a heat is much the same as conventional open-hearth shop practice.

16-112. **Effect of Moisture Additions to the Air Delivered to Blast Furnaces.** L. E. Riddle. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 965-970.

Controlled moisture additions to the blast delivered to the furnaces bring about: Decrease in iron production of approximately 0.5% per grain of moisture added; increase in the coke rate of approximately 1.2% per grain of moisture added; negligible difference in blast furnace regularity and flue dust production; no significant difference in iron quality.

16-113. Setting up Stack Drafts on Combustion Cross-Regenerator Ovens. J. R. Purdy. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 973-975.

Heating of ovens underfired with coke oven gas. Setting of drafts on a new battery; selection of standard regenerator.

16-114. Maximum Economical Blowing Rates. Roger S. Wilcox. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 986-990.

Economical aspect; cost with flue dust production; method of computing flue dust produced.

16-115. Ignition Through Fuel Beds on Traveling or Chain Grate Stokers, Part II. E. P. Carman and W. T. Reid. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 1002-1005.

Curves of ignition for high temperature coke, coke breeze. Ignition through fuel beds on traveling-grate stokers is essentially unrestricted underfeed. After ignition reaches the grate, burning is over-feed, and increase of air rate will give proportional increase of burning rate. Slow initial ignition of the top layer of fuel on traveling-grate stokers is followed by relatively slow rates of ignition travel through the bed. Moisture is necessary to "temper" small-size fuels.

16-116. Symposium on Measurement of Heat Absorption in Furnaces: Part V. *Industrial Heating,* v. 12, Aug. '45, pp. 1318, 1320.

The measurement of heat flow from furnace walls, by Charles B. Bradley.

16-117. New Trends in Metallurgical Heating. *Industrial Heating,* v. 12, Aug. '45, pp. 1340, 1342, 1344, 1346.

Special furnaces and methods; high speed heat transfer; heating light alloys; induction heat treatment of bar stock; flowing electrolytic tin plate; heat treating by radio frequencies.

16-118. Basic Principles of Combustion Engineering of Hot-Dip Galvanizing Furnaces, Part XXXI. Wallace G. Imhoff. *Industrial Gas,* v. 24, Aug. '45, pp. 20-21, 36-40.

General review of vital principles involved.

16-119. Developments in Design and Use of Side-Blown Converter Plants. *Industrial Heating,* v. 12, Aug. '45, pp. 1348, 1350, 1394-1395.

Use of the side-blown converter in Great Britain for the manufacture of steel for castings. Summarizes the results of an investigation reported by P. C. Fassotte in a recent paper before the British Iron and Steel Institute.

16-120. Heating Metals and Non-Metallic Materials by Electronics. H. L. H. *Machinery* (London), v. 67, Aug. 9, '45, pp. 141-147.

Considers briefly the ways in which induction and dielectric heating are produced; types of induction heating equipment; elements of an induction heating unit; examples of coils; applications of dielectric heating.

16-121. Electrode Salt Baths. *Automobile Engineer,* v. 35, Sept. '45, pp. 376-378.

Temperature range; general description; electrical equipment; dip-type pyrometer; operating data; multi-purpose use.

16-122. **Cleaning Blast-Furnace Gas.** *Coke and Smokeless-Fuel Age,* v. 7, Sept. '45, pp. 169-171, 182.

Recent American experience discussed with reference to the use of both the wet and dry methods.

16-123. **The Distribution of Materials in the Blast Furnace, Part I.** H. L. Saunders and R. Wild. Iron & Steel Institute, Advance copy, Sept. '45, 28 pp.

Distribution of materials in the blast furnace has been studied by the aid of small-scale models, using materials of correspondingly small size. The nature and extent of segregation depend upon the character of the materials, e.g., variation in size, shape, density, and moisture content, considered in relation to the furnace lines, bell and throat design, etc. Such variables are treated first singly and then in groups, the distribution patterns obtained being followed photographically. The form of the stock-line contour, which can be deduced from a knowledge of the trajectories, largely determines the initial distribution, which generally persists throughout the furnace shaft. Some examples of burden flow with spherical material are considered.

16-124. **Some Aspects of Electric Melting in the Foundry.** F. A. Rivett. *Foundry Trade Journal,* v. 77, Sept. 6, '45, pp. 3-10.

Some typical installations in ferrous and non-ferrous foundries. Arc furnaces; direct-arc furnaces; main application; steel; alloy irons; rocking indirect-arc furnaces; resistor furnaces; Nichrome type; rocking resistor furnaces; carbon trough or granular resistor furnaces; induction furnaces; low frequency furnaces; high frequency or coreless induction furnaces.

16-125. **Blast Furnaces.** T. L. Joseph. *Iron & Steel,* v. 18, Sept. '45, pp. 409-414.

Not a great deal of work has been done on the problem of dust loss in the blast furnace. Theoretical aspects of high top pressure and its influence on gas velocity with brief details of some practical tests.

16-126. **Tube Failures in Water-Tube Boilers.** *Combustion,* v. 17, Sept. '45, p. 44.

An unusual type of tube failure pertains to floor tubes in slag-bottom furnaces.

16-127. **Submerged Air-Gas Burner for Pickling Tanks.** A. M. Hoffmann. *Industrial Gas,* v. 24, Sept. '45, pp. 13-14.

Submerged combustion for heating pickling solutions operates on the same principle as the submarine cutting torch. It creates a pocket of air around the flame to prevent the water from dousing it.

16-128. **Hot-Air Aging Furnace at Consolidated Vultee Plant.** *Industrial Gas,* v. 24, Sept. '45, pp. 20-21, 34.

Gas-heated hot air furnace for accelerated age hardening of aluminum alloy aircraft parts. Oven dimensions

listed; temperature kept within 2°; automatic control; weight of empty furnaces; control regulates heat of five sections.

16-129. **Working of a Multi-Tubular Gas-Fired Infra-Red Oven.** W. A. Fitzsimmons. *Industrial Gas,* v. 24, Sept. '45, pp. 22, 34.

Details of the performance of an infra-red oven used for experimental work on the drying of metal finishes.

16-130. **Malleablizing Iron Castings.** J. Fallon. *Foundry Trade Journal,* v. 77, Sept. 20, '45, pp. 53-56.

Development in technique which has found much favor in the U.S.A. Application of a sealed radiant tube heated bell-type furnace, for malleable iron castings. Furnace shows great flexibility in dealing with malleable castings of a wide range of compositions. Packing materials and annealing pans, which rapidly deteriorate and often exceed the weight of the effective load of castings, are eliminated. Bell-type radiant tube furnace provides facilities for effecting rapid air-quench, equalization and progressive slow cooling under absolute control.

16-131. **A New Departure in the Control of Furnace Dampers.** *Metallurgia,* v. 32, Aug. '45, pp. 179-180.

Fine adjustment of a heat treatment furnace damper plays an important part in the maintenance of controlled atmosphere conditions within the furnace chamber, but the damper control unit described is a new development.

16-132. **Acid Electric Furnace Carbon Control.** Charles Locke. *Iron Age,* v. 156, Oct. 18, '45, pp. 69-71, 176B.

Practical aspects of carbon control, the various types of equipment and procedures that can be used, and other factors leading to consistent quality heats.

16-133. **Explosions—Old and New.** C. Whitworth. *Machinery* (Lloyd), v. 17, Sept. 1, '45, pp. 47-52.

Explosions involving combustion; explosion of endothermic substances; use of atomic energy; some problems raised.

16-134. **Completely Automatic Control of Open Hearth Reversal.** B. M. Larsen and W. E. Shenk. *Canadian Metals & Metallurgical Industries,* v. 8, Sept. '45, pp. 42-43.

Reversal control designed so that, under operating conditions, no arbitrary limitation is imposed other than to keep the reversal interval within the optimum range.

16-135. **Melting Furnaces and Melting Practice.** L. W. Bolten. *Foundry,* v. 73, Oct. '45, pp. 100-103, 190, 193, 196, 199.

Trends in British melting practice. 6 ref.

16-136. **Numerous Processing Ovens Used in Producing Pratt & Whitney Double Wasp Engines.** *Industrial Heating,* v. 12, Oct. '45, pp. 1753-1754, 1756, 1758, 1760, 1762-1765.

Four crankcase shrink ovens were installed in the production lines to eliminate unnecessary handling of parts. These are electrically heated units. Three paint-dry ovens are used. One is 188 ft. long and is steam heated. The other two are electrically heated. Two normalizing ovens for cylinder heads, laboratory ovens for small parts, and

truck-loaded box-type ovens for treating connecting rods are some of the other oven equipment in the plant. Describes in some detail representative examples of each type of oven used.

16-137. **A High Temperature Electric Tube Furnace.** J. W. Gartland. Electrochemical Society Preprint 88-11, 1945, pp. 123-134.

Details of construction of a practical, electrically heated carbon tube furnace. Furnace may be rapidly heated to 3000° C., or any lower temperature and held within ±20° C. of any end temperature for several hours. A uniform black body chamber of at least 15 in. length and 2 in. diameter is provided having a capacity of 300 to 500 grams of charge. Volt-ampere characteristics and energy values are given which are valid for the design of larger units.

16-138. **Pit Furnaces at Lukens.** H. S. Hall. *Iron & Steel Engineer,* v. 22, Oct. '45, pp. 81-86.

Of special design, these pit furnaces heat a wide range of slab ingot sizes with excellent results, using natural gas or fuel oil with equal facility.

16-139. **Electric Furnace Construction and Operation, Part I and II.** J. C. Howard, G. L. Willan, James M. Mowat and James A. Anderson. *Journal,* West of Scotland Iron & Steel Institute, v. 52, Part I, 1944-45, pp. 1-18.

Construction and maintenance of electric arc furnaces; basic electric arc furnace practice.

16-140. **New Information on Large and Small Gas Immersion Tubes, Part I.** William R. Teller. *Industrial Heating,* v. 12, Nov. '45, pp. 1906, 1908, 1910, 1912, 1914, 1916, 1918.

Basic performance characteristics of large gas immersion tubes considered.

16-141. **The Problem of Reversing Regenerative Furnaces.** *Industrial Heating,* v. 12, Nov. '45, pp. 1923-1924.

Some of the important factors related to the control of reversal of regenerative furnaces summarized. (Paper for Association of Iron and Steel Engineers.)

16-142. **Flexibility of Operation Features Acme Steel Treating Plant in Detroit.** *Industrial Heating,* v. 12, Nov. '45, pp. 1982, 1984, 1986, 1988, 1990, 1992.

Describes various furnaces and other facilities.

16-143. **Numerous Processing Ovens Used in Producing Pratt & Whitney Double Wasp Engines, Part II.** *Industrial Heating,* v. 12, Nov. '45, pp. 1955, 1956, 1958, 1960-1963.

Master and articulating-rod normalizing ovens; small shrink ovens; paint drying ovens.

16-144. **German Practice in Total Gasification, Section III.** *Gas Times,* v. 40, Oct. 27, '45, pp. 33-36.

Systems employing direct heat transfer by means of an internal circulating system of superheated gases. 11 ref.

16-145. **The Instrumentation of Soaking Pits.** J. P. Vollrath. *Blast Furnace & Steel Plant,* v. 33, Nov. '45, pp. 1391-1393.

Precise measurement and control of all variables is now common practice. Refinements in the design of soaking pit furnaces.

16-146. Operation of Small Vs. Large Blast Furnaces. *Steel,* v. 117, Nov. 19, '45, pp. 135, 191.

Efficiency of small and large hearth diameter stacks, methods of blowing them out and problems with which by-product cokemakers are faced. Discussed at meeting of Blast Furnace and Coke Association of the Chicago district and the Eastern States Blast Furnace and Coke Oven Association.

16-147. West Coast Steel Foundry Uses Large Furnaces. Raymond L. Collier. *Foundry,* v. 73, Dec. '45, pp. 98-100.

Describes two large electric melting furnaces.

16-148. A Thermal Engineer's View of an Arc Furnace. Victor Paschkis. Electrochemical Society Preprint no. 88-20, Oct. '45, 8 pp.

Outlines problems from a thermal viewpoint.

16-149. Consistency in the Analysis of Combustion Products in Furthering Fuel Efficiency. J. Jennings. *Steel Processing,* v. 31, Nov. '45, pp. 709-711, 714.

Burning of pure carbon; effect of hydrogen; incomplete combustion with hydrogen in products; gaseous fuels; the H/C ratio; universal consistency formula.

16-150. The Problem of Flame Radiation With Particular Reference to Melting Furnaces. T. F. Pearson. *Metal Treatment,* v. 12, Autumn, '45, pp. 139-145, 199.

Discusses possibilities of increasing thermal efficiency of melting furnaces by modification of flame. Also suggests a classification for fuels based upon the weight ratio between "luminosity carbon" (i.e., the carbon obtainable chiefly from tar vapors and hydrocarbons) and hydrogen. 5 ref.

16-151. Notable Electric Heat Treatment Furnaces. *Metal Treatment,* v. 12, Autumn, '45, pp. 171-176, 182.

Deals with various recent designs of electric heat treatment furnaces and indicates their suitability to various production methods. Their dependability and clockwork accuracy also stressed.

16-152. Final Additions to an Acid Electric Heat. Conrad C. Wissmann. *Metal Progress,* v. 48, Dec. '45, pp. 1296-1299.

Outlines good practice for meeting required chemical specification, and reasons for some of the important recommendations in problems of furnace maintenance, charging and working a heat, and deoxidizing a heat of acid electric steel.

16-153. Combustion Control. *Steel,* v. 117, Dec. 10, '45, pp. 134, 136, 139.

Reduces fuel costs, furnace repairs, and insures uniformity of product.

16-154. Theoretical Limiting Efficiency of Various Fuels in the Open-Hearth. B. M. Larsen and C. Siddall. *Iron & Steel Engineer,* v. 22, Dec. '45, pp. 76-96, 115.

Theoretical survey of various fuels for open-hearth use brings out certain factors which should be borne in mind in long-range consideration of problems of fuel selection and furnace design.

16-155. **Vacuum Metallurgy.** W. J. Kroll. *Metal Industry,* v. 67, Nov. 16, '45, pp. 323-324.

Melting and evaporating metals at reduced pressures; deals with electric furnace heating.

16-156. **Electric Furnacemen Exchange Ideas on Shop Practice.** *Steel,* v. 117, Dec. 17, '45, pp. 112, 114, 160.

Preparation of scrap affords recovery of alloys and removal of tramp elements. Savings in operating time, power, and cost and maintenance of electrodes are attributed to automatic electrode control. Less erosion at the joint in ladle linings is reported by laying brick dry without clay dip.

SECTION XVII

REFRACTORIES AND FURNACE MATERIALS

17-1. **Drilling Pyrometer Holes Through Furnace Linings.** K. J. Trigger. *Metal Progress*, v. 47, Jan. '45, pp. 95-96.

Drilling 1⅜-in. holes through a 5-in. firebrick sidewall.

17-2. **Significance of a Testing Program for Glass-Plant Refractories.** R. K. Smith. American Ceramic Society *Bulletin*, v. 23, Dec. 15, '44, pp. 457-460.

The economic significance of testing refractories; two general types of refractory failures (those due to heat alone and those due to heat plus contamination) considered. Tests applicable to each type discussed. A sag test and a reheat test which have been found useful in evaluating failures due to heat alone described; factors involved in testing refractories for failure from chemical attack discussed.

17-3. **Significance of Navy Spalling Test.** W. T. Tredennick. American Ceramic Society *Bulletin*, v. 23, Dec. 15, '44, pp. 460-463.

With the development of the Navy spalling test, thermal spalling in naval boilers has been reduced from a major to a minor cause of failure. The advantages of the test are pointed out and illustrated by showing the results of service trials of brick giving 26, 8, 3.5 and 1% loss in the test.

17-4. **Reheat Tests on Fire-Clay and Silica Refractories.** Earl C. Petrie and Charles P. Walters. American Ceramic Society *Bulletin*, v. 23, Dec. 15, '44, pp. 464-468.

Test data on fire-clay and silica refractories are presented which show the effect of firing temperature and its relation to the changes brought about in the standard A.S.T.M. reheat tests.

17-5. **The Practical Aspects of Reheating and Heat Treatment Furnace Insulation.** A. Stirling. Institute of Fuel *Journal*, v. 18, Dec. '44, pp. 39-50.

After-insulation depends on structural factors which cannot be entirely separated from operational, and possibly design factors. An inspection of the structure must precede after-insulation. Circular roofs must have a suitable thickness and rise for their span. Sidewall insulation expansion joints should be carefully

detailed. Air spaces may often be insulated with powder fillings. Hearth and foundation insulation is facilitated by the insulated concretes. The insulating refractories and concretes are appropriate to hearths of mechanical furnaces and to bogies and bogie tracks. 32 ref.

17-6. **Basic Brick in Open-Hearth Construction.** H. M. Griffith. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 104-106.

Experiments with all basic construction on one end of a 50-ton furnace; after 750 heats on the furnace the basic brick was standing up well. Rebuilding time was less than half of that required on the silica end. Removal of slag was no problem as it was granular in character and was raked out from time to time while the furnace was in operation.

17-7. **Refractories in 1944.** Louis A. Smith, *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 114-115.

Low alumina, super silica brick is now accepted and coming into its own in plants where it was considered more of a fancy than a fact. Keener interest in brick made from conglomerate rock has sprung up. The all basic furnace; cold rammed bottoms; the Mt. Savage Plant; industry should establish refractories research.

17-8. **Economic Thickness of Thermal Insulations for Intermittent Operations, Part II.** C. B. Bradley, C. E. Ernst and V. Paschkis. *Industrial Heating,* v. 12, Jan. '45, pp. 114, 116, 118, 120, 123-124, 126.

Presents a method for determining economic thickness based upon the electrical analogy method. Application of the method and its limitations are discussed at length. Influence of intermittency on the economic thickness is discussed for one specific case.

17-9. **Converter Refractories.** Wm. C. Cress. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 854-870.

Describes the tests and procedures used to select the proper materials and mixture. The mixture selected on this basis gave better than 100% improvement in refractory lining life over a previous mixture. 10 ref.

17-10. **High Temperature Heat Insulation.** G. W. Paterson. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 927-944.

Methods and applications for the use of various types of insulating and refractory insulating materials. Comparisons are made as to the heat loss sustained under various types of construction. Consideration is also given to the "maturing" effect upon certain refractories when insulation is used and also places where it should not be used.

17-11. **Construction and Maintenance of Arc Furnace Lining.** N. F. Dufty. *Steel,* v. 116, Feb. 5, '45, pp. 118-119, 134, 136.

Shapes should be kept to minimum number. Support of electrode coolers requires careful consideration to avoid cumulative trouble. High-power modern furnaces have created a demand for brick capable of

standing up under high voltages and intense arcs. Metal case magnesite recommended for sidewall lining. Dolomite employed to reduce consumption of chromite and magnesite.

17-12. **The Steel Industry Talks About Refractories.** *Brick & Clay Record,* v. 106, Feb. '45, pp. 43-45.

Most steel men expect little peacetime decrease in refractories use. Few wartime failures have been noted. Greatest demand is for more uniformity.

17-13. **Construction and Maintenance of Arc Furnace Lining.** N. F. Dufty. *Steel,* v. 116, Feb. 12, '45, pp. 114, 154, 157, 158, 160, 162-164.

Dolomite, when carefully graded and fully rammed, affords high packing density in hearth construction. Various steps involved in burning-in operation are presented. Five causes of hearth troubles described in detail and remedies suggested. Choice of brick summarized.

17-14. **Completes Test Run on Mullite Open Hearth Roof.** C. W. Fyfe. *Steel,* v. 116, Feb. 19, '45, pp. 128, 164.

Construction employed for laying up furnace roof of this type refractory at an Ohio shop results in pinching and eventually spalling from the knuckle to the endwall. Since installation of new center section little or no erosion has occurred. Future plans call for fully suspended center section from knuckle to knuckle. Mullite is used in many types of furnaces in the steel industry.

17-15. **Reaction Between Copper Reverberatory Slag and Refractories.** Sahap S. Kocatopcu. American Ceramic Society *Journal,* v. 28, March 1, '45, pp. 65-71.

Small slag cylinders placed on top of different refractory brick were heated at 1300 and 1400°C. Depth and width of reaction and diffusion zones were measured, and thin sections through the penetrations were studied.

17-16. **A New Development in Insulation.** H. D. Minich. *Wire & Wire Products,* v. 20, March '45, pp. 203-204.

Review of the work of Tensolite Corp. so that electronics engineers and executives might become better acquainted with this unique process.

17-17. **The Manufacture of Refractory Insulating Products, II.** J. F. Clements, L. R. Barrett and A. T. Green. *Brick & Clay Record,* v. 106, March '45, pp. 55-56, 58.

Late developments in formation of pores by mechanical frothing and by chemical bloating are discussed. Other methods classified.

17-18. **Economic Thickness of Thermal Insulation for Intermittent Operations: III.** C. B. Bradley, C. E. Ernst and V. Paschkis. *Industrial Heating,* v. 12, Feb. '45, pp. 290, 292, 294, 296.

Considers the most economic thickness as that yielding the smallest sum of cost of heat loss and fixed cost of installation. A method for determining this economic thickness is described which is based upon the

electrical analogy method, and its applications and limitations discussed. (Presented at the Semi-Annual meeting, American Society of Mechanical Engineers, Pittsburgh, June '44.) 11 ref.

17-19. **The Behaviour of Refractory Materials Under Stress at High Temperatures.** F. H. Clews, H. M. Richardson, and A. T. Green. British Ceramic Society *Transactions,* v. 43, Nov. '44, pp. 223-240.

Deformation of porcelain has been studied at temperatures from 900° to 1100° C. using tensile and torsion-stress. Over extended periods stress and time-hardening occurs. Different types of deformation discussed with reference to typical time-deformation curves.

17-20. **Properties of Refractories.** J. A. Kayser. *Foundry,* v. 73, April '45, pp. 113-114, 224, 226, 228.

Properties of the various types of refractories. Methods of manufacture which have some bearing on the properties and the shortcomings and advantages. (Presented at the eighth annual Foundry Conference, Milwaukee.)

17-21. **Permeable Refractories for Furnaces.** D. C. Gunn. *The Gas Times,* v. 40, no. 517, Sept. 2, '44, p. 24. *Engineers' Digest* (American Edition), v. 2, April '45, p. 184.

Hot face or fireclay insulating material which is burnt with carbonaceous material included in it. On firing, the carbonaceous material burns out, and leaves a porous structure, resulting in a brick possessing exceptional properties. These properties are low thermal conductivity and low thermal capacity.

17-22. **The Durability of Refractories.** W. J. Rees. Birmingham Metallurgical Society *Journal,* v. 24, June '44, pp. 102-117. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 118-A.

Factors affecting the life of refractory bricks and cements discussed. Firebricks which contain any free iron oxide disintegrate rapidly if used in a furnace where carbon monoxide is present. If the brick is burnt under reducing conditions at the peak temperature of the kiln the oxide combines with the clay to form a complex silicate which is unaffected by carbon monoxide. Furnace walls have failed recently when the fuel has been changed from ordinary fuel oil to crude pitch oil; this may be due to ash which is rather high in iron oxide settling on the wall or to faulty burner control causing the oil to be carried forward so as to burn on the face of the brick.

17-23. **Classification of Natural Organic Binders.** Edward P. McNamara and Jay E. Comeforo. *Refractories Journal,* v. 21, March '45, pp. 120-123.

Modulus of rupture, loss on tumbling, migration, water absorption, and burn-out characteristics were studied using a series of organic compounds representative of the types used as binders for ceramic materials. The results are interpreted in terms of the constitution of the organic compounds in terms of the

mechanism of specific adhesion. The binding strength of an organic material may be predicted from a knowledge of its molecular constitution.

17-24. **Basic Bricks—I.** *Iron & Steel,* v. 18, April '45, pp. 110-115, 119.

Methods whereby the effects of the almost total loss of magnesite imports have been overcome and a new industry created.

17-25. **Refractory Concrete for Furnace Construction.** Gerald T. Haddock. *Metals & Alloys,* v. 21, Feb. '45, pp. 395-400.

Review of the characteristics, uses and methods of applying refractory concrete—a group of special refractory materials that can be poured in place to give intricate, joint-free, high temperature (or insulating) furnace structures of a wide variety of types.

17-26. **Controlling Furnace Erosion.** Edwin N. Hower. *Steel,* v. 116, April 30, '45, pp. 118-121.

Drop sections of silica brick along open-hearth skewback help to prolong roof life. Basic brick found advantageous in making front and backwall repairs. Masonry crews trained in the art of hot patching roofs have been found highly beneficial in many open-hearth shops.

17-27. **Heat Losses and the Insulation of Open-Hearth Furnaces and Blast Furnaces.** J. M. Ferguson. Institute of Fuel *Journal, (Wartime Bulletin),* April '45, pp. 142-150, 166.

Large numbers of heat units lost in process, and considers the possibilities of reducing these losses by an increased use of the insulating materials which are serviceable at the temperatures met with in iron and steel manufacture.

17-28. **Valves for Modern Open-Hearth Furnaces.** A. G. Arend. *British Steelmaker,* v. 11, May '45, pp. 214-217.

Use of water-seals; valves without water connections; water-cooling without water-sealing.

17-29. **Silicon Carbide Roller Hearths for High Temperature Industrial Furnaces.** Matthew L. Snodgress. *Industrial Heating,* v. 12, May '45, pp. 834, 836.

Silicon carbide rollers provide a means of conveying material through furnaces or kilns at increased efficiency due to elimination of sensible heat losses. Range of temperature, speed of material through the furnace and hearth loads are extended beyond commonly accepted practice through the use of this type of roller, and replacement and maintenance costs of roller-hearth furnaces are thereby greatly reduced.

17-30. **Density of Open-Hearth Furnace Bottoms.** Roland B. Snow. *Industrial Heating,* v. 12, May '45, pp. 838, 882-883.

Relative densities of open-hearth bottoms produced by several different methods from a variety of materials.

17-31. Classification of Natural Organic Binders. Edward P. McNamara and Jay E. Comeforo. *Refractories Journal,* v. 21, April '45, pp. 165-172.

Modulus of rupture, loss on tumbling, migration, water absorption, and burn-out characteristics were studied using a series of organic compounds representative of the types used as binders for ceramic materials. The results are interpreted in terms of the constitution of the organic compounds and in terms of the mechanism of specific adhesion. The binding strength of an organic material may be predicted from a knowledge of its molecular constitution.

17-32. Investigation of Refractory Material for Tapping Equipment. L. O. Uhrus and K. Oberg. *Jernkontorets Annaler,* v. 128, no. 12, '44, pp. 597-609. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 143-A.

17-33. Service Life of Open-Hearth Silica Brick Roofs. *Steel,* v. 116, June 18, '45, pp. 114, 158.

Consideration of the physical conditions of open-hearth roofs and of individual bricks as well as the chemical changes which occur during service reveals that the wear of roof bricks takes place as the result of liquid flowing from considerable distance within the brick.

17-34. Basic Bricks, II. *Iron & Steel,* v. 18, May '45, pp. 147-149, 159.

Manufacture of stabilized dolomite bricks and cements.

17-35. Carbon Products as Used in Various Metallurgical Applications. *Blast Furnace & Steel Plant,* v. 33, June '45, pp. 721-724.

New carbon applications; graphite riser rods; graphite molds; graphite chill molds; mold wash; pickling tanks; heat exchangers; graphite crucibles for induction furnaces.

17-36. Industrial Electrodes, I. H. Sanders. *British Steelmaker,* v. 11, June '45, pp. 255-259.

Carbon; genesis of the electrode; carbon and graphite electrodes; form of electrodes; choice of electrodes; iron and steel manufacture; mechanical properties; advantages of graphite; non-ferrous metals; electrolysis.

17-37. Some Recent Developments in the Manufacture of Refractories. L. Sanderson. *Refractories Journal,* v. 21, May '45, pp. 186-190.

Ingot heating furnace; electric furnace; blast furnace; insulation; ladles, stoppers and nozzles; bricks for blast furnaces; basic materials; sillimanite products; magnesia clinker; vitrifaction process.

17-38. Carbon Refractories Meet Severe Temperature Conditions. *Refractories Journal,* v. 21, May '45, pp. 195-197.

Special shapes; hollow sections; cement and pastes.

17-39. Special Brick Shapes for Cupola Refractories. H. M. Hazeltine. *American Foundryman,* v. 7, July '45, pp. 44-45.

Over a period of years, considerable difficulty had been experienced in cupola operations because of tap hole, trough, slagging spout and cupola wall refractory failures. Use of firebrick shapes, specially designed for particular applications, eliminated the refractory troubles and made possible substantial operating economies.

17-40. **English Blast Furnacemen Study Carbon Brick for Hearth Lining.** *Steel,* v. 117, July 23, '45, pp. 125, 128.

Investigation of carbon brick for lining blast furnace hearths stresses the importance of accuracy of shape and size. Use of preformed carbon for lining iron and slag runners holds promise. Patching, hearth lining with carbon brick eliminates breakouts at that area.

17-41. **Developments in the Use of Lumnite Cement at Gary Works Coke Plant.** James E. Ludberg. *Blast Furnace & Steel Plant,* v. 33, July '45, pp. 830-834.

Oven door linings; procedure for lining doors; miscellaneous maintenance uses of lumnite; construction uses of lumnite; corrosion resistant concrete uses.

17-42. **Hot Patching of Open-Hearth Furnaces.** Edwin N. Hower. *Steel,* v. 117, July 30, '45, p. 103.

Types of roof patches; furnace cost curve. (Paper presented before Open Hearth Committee, American Institute of Mechanical Engineers, Pittsburgh).

17-43. **Industrial Electrodes, II.** H. Sanders. *British Steelmaker,* v. 11, July '45, pp. 303-307.

Electrode tolerances; how the electric furnace began; experimental work; furnace progress; continuous electrodes; linking pin; counterboring; properties of carbon electrodes; electrical resistivity.

17-44. **Permeable Refractories in Furnace Construction.** *Iron Age,* v. 156, Aug. 23, '45, pp. 70-71, 141-142.

Large production experimental units in England, wherein the products of combustion are withdrawn through the permeable refractory lining, show considerable promise. The refractories show no tendency to clog and furnace operation appears quite reliable.

17-45. **Industrial Electrodes—III.** H. Sanders. *British Steelmaker,* v. 11, Aug. '45, pp. 359-363.

Direct arc furnace requirements; oxidation resistance; handling electrodes; jointing the electrode; warehousing; adding a new section; the jointing compound.

17-46. **A New Method of Constructing High Density Blast Furnace Bottoms.** Fred M. Miller. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 984-985.

Development in recent years in the technology of ramming mixes and their wide use today makes it possible to expand their use to include blast furnace bottom construction. View of a fractional course of bottom blocks rammed in place against an adjustable form. The brick are set in place far enough apart to permit the use of pneumatic ramming tools between the blocks for compacting the ramming mix to a high density.

17-47. Further Progress in the Development of Refractory Materials. L. Sanderson. *Refractories Journal,* v. 21, July '45, pp. 274-278.

Service life; panel spalling test; apparent thermal conductivity; monolithic linings; roof thickness; action of steam and sulphur dioxide; chlorine attack; sodium salts; dolomite; magnesia-zircon linings; manganese attack.

17-48. Western Steel Plant Obtains 178 Heats From Electric Furnace Roof. E. G. Jones. *Steel,* v. 117, Sept. 10, '45, pp. 124, 127, 130.

Ample expansion joints are provided in laying up roof lining on 40-ton electric furnaces at Pacific Coast plant. New roofs are preheated for 60 hr. before installing on hot furnace. After first heat is tapped roof is cleaned and thin mixture of sillimanite swept into joints. Long life of refractories is obtained.

17-49. Refractories and Masonry Discussed at the Chicago Section Open-Hearth Conference. *Industrial Heating,* v. 12, Aug. '45, pp. 1380, 1382, 1384, 1386, 1388, 1390.

Basic refractories; outlook for all-basic furnace; bottom refractories; density of open-hearth bottoms; super-duty silica brick; suspended silica roofs.

17-50. Permeable Refractories for Furnace Construction. R. H. Anderson, D. C. Gunn and A. L. Roberts. *Gas Journal,* v. 244, July 26, '44, p. 117. *Engineers' Digest* (American Edition), v. 2, Aug. '45, pp. 410-411.

Refractory insulation has been widely and successfully used on the hot face of fuel-fired and electric furnaces working up to 1200° C. or even higher. It has given good heat insulation, and has low thermal capacity.

17-51. The Mechanism of Wear of Open-Hearth Silica Brick Roofs. Mervin A. Fay. *Blast Furnace & Steel Plant,* v. 33, Sept. '45, pp. 1106-1107, 1122-1125, 1127.

Postulates a new theory which agrees with all the known facts concerning the cause of wear. 3 ref.

17-52. Open-Hearth Basic, Silica and Bottom Refractories. V. Gregor. *Industrial Heating,* v. 12, Sept. '45, p. 1564.

Basic refractories, silica refractories and bottom materials for open-hearth furnaces used in the U. S. Steel Corp. plant are enumerated and their use and average consumption discussed.

17-53. Refractories and Masonry Discussed at the Chicago Section Open-Hearth Conference: Part II. *Industrial Heating,* v. 12, Sept. '45, pp. 1566, 1568, 1573-1574.

Mechanism of silica-roof wear, hot-patching practices and the testing of graphite stopper heads.

17-54. The Application of Infra-Red Radiation to the Drying of Refractories. A. L. Roberts. *Refractories Journal,* v. 21, Aug. '45, pp. 301, 303, 305-313.

Outlines mechanism of radiant-heat transfer, and indicates the possibilities that this method offers for increasing both speed and efficiency of refractories drying.

17-55. More News of Progress in the Development of Refractories. L. Sanderson. *Refractories Journal,* v. 21, Aug. '45, pp. 316-319.

Fireclay and silica bricks; testing; presence of steam; insulating bricks; furnace wall patching; carbon and graphite; dolomite; syphon brick; permeability; stabilized dolomite clinker; X-ray inspection of stoppers.

17-56. **Properties and Care of Ladle Nozzles and Stoppers.** *Steel,* v. 117, Oct. 8, '45, pp. 126, 184.

Selection of nozzles and heads on the basis of modern technical knowledge, plus the development of proper techniques, will aid in meeting the strict pouring requirements imposed upon the manufacturer by the high quality standards of the steels produced today.

17-57. **Carbon Lining Prevents Formation of Salamander.** *Steel,* v. 117, Oct. 8, '45, p. 128.

Six stacks in this country employ carbon brick or paste in hearth construction. One carbon lining is on order and three are contemplated. Carbon mold plugs are in development stage; mold inserts are on trial. Runner lining promises new use for carbon.

17-58. **Refractories Performance Records.** Mervin A. Fay. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 101-107.

Records of performance are necessary to evaluate the various refractories. They aid in the design of furnaces and provide a guide for research in the development of improved refractories.

17-59. **Cleaning Open-Hearth Checkers by Vacuum.** A. F. Franz. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 108-111.

Application of steam jet vacuum systems in cleaning out open-hearth checker chambers and flues has shown marked economies.

17-60. **Developments in the Use of Lumnite Cement.** James E. Ludberg. *Steel,* v. 117, Oct. 22, '45, pp. 137-138, 140, 142.

Liberal portion of coarse firebrick aggregate beneficial to coke oven door linings. Clean used fiber brick from blast furnace stoves provides better aggregate than new brick. Thorough soaking of aggregate prior to mixing prevents a false quick set. Concrete lined coke oven doors installed on cold ovens give longest service life.

17-61. **Hot Patching of Open-Hearth Furnaces.** Edwin N. Hower. *Industrial Heating,* v. 12, Oct. '45, pp. 1766,1768,1770.

Discusses the present practices employed in the U. S. Steel Corp. plant for hot patching open-hearth furnaces, notably for patching roofs. Condensation of a paper presented before AIME Open-Hearth Committee.

17-62. **Furnace Efficiency Up—Repair Costs Down.** Robert M. Hays. *Western Machinery and Steel World,* v .36, Oct. '45, pp. 474-475.

Demonstration illustrating the advantages of oil base refractory coatings.

17-63. **Report of American Ceramic Society Committee on Research.** Arthur A. Wells. *Refractories Journal,* v. 21, Oct. '45, pp. 393-395.

Value of tests from practical and research standpoint and significance of testing program on steel-plant refractories and glass-plant refractories discussed. Test data on fireclay and silica refractories presented.

17-64. **The Density of Open-Hearth Bottoms.** R. B. Snow. *Blast Furnace & Steel Plant*, v. 33, Nov. '45, pp. 1394-1397.

Fundamental information concerning problem of rammed densities. Tests already show that a density of 2.57 to 2.62 can be attained.

17-65. **Developments in the Use of Lumnite Cement at Gary Coke Works Plant.** James E. Ludberg. *Industrial Heating*, v. 12, Nov. '45, pp. 1966, 1968.

Various uses of Lumnite cement in coke-oven plants, notably in lining oven doors discussed. (Paper presented before the Blast Furnace & Coke Oven Association.)

17-66. **Mechanized Mold Preparation.** *Industrial Heating*, v. 12, Nov. '45, pp. 1972, 1975.

New system of mold preparation uses less than half a pound of prepared coal-tar pitch per ton of ingots. Operations given.

17-67. **Refractories in the Extraction of Copper.** W. H. Dennis. *Metal Treatment*, v. 12, Autumn, '45, pp. 147-158.

Discusses constant demand for increased efficiency of recovery and decreased costs requiring progressive improvement in use of refractories.

17-68. **Steel Foundry Refractories.** A. H. B. Cross. *Metal Treatment*, v. 12, Autumn, '45, pp. 183-192.

Refers to trend in choice of melting units for steel foundries and gives quantitative data concerning the refractories used in each type of furnace. Also deals with ladle requirements.

SECTION XVIII

HEAT TREATMENT

18-1. **Subzero Treatment of Steels.** H. C. Amtsberg. *Western Metals*, v. 2, Dec. '44, pp. 34, 36-38.

Presentation of the fundamentals of cooling hardened steels to temperatures considerably below room temperature, properly correlated with the basis treatment cycle and related structural changes. 11 ref.

18-2. **Some Peculiarities of Heating Steel by Induction.** George I. Babat. *Journal of Applied Physics*, v. 15, Dec. '44, pp. 835-839.

The principal electrical and magnetic characteristics of steel; the striated heating effect.

18-3. **The Nitriding of High-Speed Steel.** *Machinery* (London), v. 65, Dec. 7, '44, pp. 627-630.

Pots and furnaces used for salt bath; pre-requisites for the successful application of the process; length of time of heating in the bath for different types of tools; other examples of the application of the process; nitriding tools by the Maxi process.

18-4. **Nitrided Steels.** E. Ineson and C. Petteford. *Iron & Steel*, v. 17, Dec. '44, pp. 735-738.

Mechanism of the process and choice of materials. 16 ref.

18-5. **Job Shop for Induction Heating.** Rex Baubie. *Steel*, v. 116, Jan. 8, '45, pp. 120, 136.

Economic value of "farming out" such work to a specializing shop is more pronounced because of (1) high cost of the equipment, (2) the limited use it would have, (3) the trained technicians its operation requires and (4) the per-unit cost of work turned out.

18-6. **High Frequency Induction Heating New Tool for the Metal Working Industry.** A. O. Wood. *Steel Processing*, v. 30, Dec. '44, pp. 795-799.

Principles; equipment; significant industrial applications.

18-7. **Application of Controlled Atmospheres to Metal Processing.** C. E. Peck. *Steel Processing*, v. 30, Dec. '44, pp. 801-804.

Annealing, hardening of ferrous metals; gas carburizing; ferrous metal brazing; sintering or powder metallurgy applications. (Presented at the semi-annual

meeting, June, 1944, of the American Society of Mechanical Engineers.)

18-8. **Reactions Between Hot Steel and Furnace Atmospheres.** Floyd E. Harris. *Metal Progress,* v. 47, Jan. '45, pp. 84-89.

Gas reactions with metallurgical products involve thermodynamic considerations. A simplified tabulation presented which requires a minimum of explanation in its application to common furnace atmospheres. Eleven reactions involving formation of compounds from five elements—carbon, oxygen, hydrogen, nitrogen and iron—are charted. Adaptability of tabulation to specific processes explained.

18-9. **Who Knows About Temper Colors on Stainless Steels?** *Metal Progress,* v. 47, Jan. '45, p. 94.

The use of temper colors may be made in tracing heat patterns, as for example, around welds supplanting its former use as a guide to heat treatment. A plea for more information.

18-10. **Continuous Heat Treating of Armor Steel Castings.** Edwin F. Cone. *Metals & Alloys,* v. 20, Dec. '44, pp. 1593-1597.

Sound furnace design and engineering and the application of advanced mechanization have made possible one of the war's most impressive processing achievements—the continuous heat treating of large cast steel tank components to close mechanical property tolerances and production requirements in an installation hitherto unmatched in size. The general engineering problem involved and the plant methods and equipment employed to solve it described.

18-11. **Heat-Treatable Nickel Alloys.** W. J. Kroll. *Metals & Alloys,* v. 20, Dec. '44, pp. 1604-1606.

Information on composition and general age-hardening behavior of the nickel-base alloys. 13 ref.

18-12. **Modification by Heat Treatment of Cast Structures and Properties.** H. T. Angus. *Foundry Trade Journal,* v. 74, Dec. 14, '44, pp. 305-307.

Discussion on a paper presented at the annual conference of the Institute of British Foundrymen. Izod values; keel bar test results; temperature of water for quenching; center line dendrites; inclusions and size of dendrites; incidence of temper carbon; the removal of dendritic formation.

18-13. **Sub-Zero Treatment of Steel.** H. C. Amtsberg. *Iron Age,* v. 155, Jan. 11, '45, pp. 50-53.

Fundamentals of cooling hardened steels to temperatures considerably below room temperature properly correlated with the basic treatment cycle and related structural changes. 11 ref.

18-14. **Producer Gas-Fired Furnaces.** *Automobile Engineer,* v. 34, Dec. '44, pp. 539-540.

An installation for the heat treatment of alloy and special steels.

18-15. **Oxy-Acetylene Heating and Flame Treating.** *Oxy-Acetylene Tips,* v. 24, Jan. '45, pp. 21-26.
Hardening; flame hardening; methods of flame hardening; flame softening; flame strengthening; drawing; forming and bending; straightening; wrinkle-bending; flame descaling; flame priming; melting.

18-16. **Short Cycle Malleabilization of White Cast Iron.** E. E. Howe. *Iron Age,* v. 155, Jan. 18, '45, pp. 66-68.
Reduction in heat treating time achieved by a procedure in which the massive cementite in the white cast iron is first decomposed and the resulting pearlite matrix is converted to spheroidized cementite, having satisfactory ductility.

18-17. **Pickling Eliminated by Continuous Salt Bath Anneal.** *Iron Age,* v. 155, Jan. 18, '45, p. 69.
Full annealing of brass cartridge cases on a continuous production heat treating basis with longest continuous conveyor-type salt bath furnaces in operation and with an absence of oxidation.

18-18. **Accurate Heat-Treatment Speeded by Push-Button Control.** James F. Carland and P. R. Watson. *Aviation,* v. 44, Jan. '45, pp. 145-146, 243-245.
Saving time, material, and manpower, new oven automatically governs heat treatment of sheet materials, with labor effort reduced to mere operation of push buttons.

18-19. **Heat-Treatment.** *Aircraft Production,* v. 7, Jan. '45, p. 31.
Regenerative town gas furnace.

18-20. **A Producer Gas-Fired Furnace Installation for the Heat-Treatment of Alloy and Special Steel Bars.** *Metallurgia,* v. 31, Dec. '44, pp. 97-98.
Installation for the heat treatment of alloy and special steel bars which is fired with producer gas.

18-21. **Protective Atmospheres in the Heat Treatment of Metals.** F. Delaroziere. (*Journal des Usines a Gaz,* v. 68, no. 1, Jan. 15, '44, pp. 2-4.). *Engineers' Digest* (American Edition), v. 2, Jan. '45, pp. 18-20.
Protective gases for non-ferrous metals; heat treatment furnaces with protective atmospheres.

18-22. **Medium Frequency Induction Hardening.** G. Seulen and H. Voss. (*Stahl und Eisen,* v. 63, no. 51, '43, pp. 929-935; and no. 52, '43, pp. 962-965.) *Engineers' Digest* (American Edition), v. 2, Jan. '45, pp. 27-30.
Induction hardening carried out either by simultaneously heating the entire surface to be hardened and quenching it as a whole, or by heating and quenching individual portions of the piece by feeding it through the stationary induction device; or the movable induction coil may be passed over the stationary piece. As the shape of the induction coil must be chosen in accordance with the contour of the piece to be treated, the closed coil enveloping the piece can only be used in cases shown. For plane surface hardening, an open coil must be used. Quenching is carried out with the

device in place, the quenching medium being applied to the heated surface by way of holes in the heating device. For progressive feed hardening combined with rotation of the piece, both the closed and the open type of induction coil are in use.

18-23. **Heat Treating.** L. S. Cooch. *Fasteners,* v. 1, no. 4, '44, pp. 11-15.

Heat treating procedures have a vital influence upon product quality and performance—progress has been made to a point where heat treatment can be controlled so that all product requirements can be met.

18-24. **Prepared Atmospheres Used in Furnaces for Heat Treating at Chrysler Tank Arsenal.** *Industrial Heating,* v. 12, Jan. '45, pp. 19-20, 22, 24, 26, 28, 30, 32, 34-36, 38, 104.

Use of prepared atmosphere in all of the heat treating furnace heating chambers which operate in the higher temperature range. Another feature is the economy of space effected by careful layout of the department and placement of the equipment.

18-25. **The Principles and Practice of Lithium Heat Treating Atmospheres, Part III.** Charles E. Thomas. *Industrial Heating,* v. 12, Jan. '45, pp. 42, 44, 46.

Use of lithium metallic vapor in atmospheres in the heating chambers of industrial furnaces for the prevention of scaling and decarburization, as carrier gas for gas carburizing, for descaling, and for restoration of carbon to decarburized steel. Carbon restoration and descaling covered here.

18-26. **From the Science of Refrigeration.** N. Nesselmann. *V. D. I. Zeitschrift,* v. 88, Feb. 19, '44, pp. 104-106.

Symposium of the refrigeration section of V. D. I., which took place Oct. 15, '43. Short abstracts of the papers presented.

18-27. **High Speed Heating with Gas.** *Steel,* v. 116, Jan. 22, '45, pp. 86-90, 129-130.

Recent improvements in equipment have forced the old rule-of-thumb heat penetration rate of 1 hr. per in. of thickness to give way to 2 to 4 min. per in. Billets, bars, tubing and strip may be brought up to high temperature in a matter of minutes as part of automatic continuous operations.

18-28. **Problems Encountered in Making and Heat Treating Castings of an Air-Hardening Steel.** Gordon W. Johnson. American Foundrymen's Association *Transactions,* v. 52, March '45, pp. 814-818.

Describes the cleaning, machining, and heat treating of air-hardening steel castings which will meet the requirements of low distortion, hardening throughout, and freedom from strains and cracking.

18-29. **Heat Treating Fasteners.** *Steel,* v. 116, Jan. 29, '45, pp. 76-77, 104, 106, 108.

National Screw & Mfg. Co. uses continuous chain-belt electric and other types of furnaces in imparting desired physical characteristics to some 15,000 standard

and 25,000 special types of bolts, cap screws, other fastening devices. Automatic temperature controls minimize individual attention to each furnace.

18-30. **Induction Heating.** *Steel,* v. 116, Jan. 29, '45, pp. 81-82, 118, 120.

Hearing before Federal Communications Commission reveals phenomenal advances.

18-31. **Queen City Steel Treating Company Performs Wide Diversity of Treatments.** E. P. Stenger. *Steel Processing,* v. 31, Jan. '45, pp. 21-25.

Company is equipped and staffed to handle all the usual heat treating operations; furnace hardening either in open furnaces or in controlled atmospheres; annealing; normalizing; stress relieving; induction hardening and brazing; flame hardening; cyaniding; liquid, pack, and gas carburizing; austempering; lead pot hardening and drawing; high speed steel salt bath hardening and furnace brazing.

18-32. **Surface Hardening and Brazing with the Induction Heater.** Gilbert C. Close. *Steel Processing,* v. 31, Jan. '45, pp. 43-46.

Inherent characteristics of the induction process give rise to a degree of product uniformity and quality control hitherto impossible to attain; advantages of heat control; cost comparison; brazing; coil design.

18-33. **Start Exploring Jominy Bar on Soft End.** Gerrit DeVries. *Metal Progress,* v. 47, Feb. '45, p. 271.

Making the first measurements at the soft end of the Jominy bar where, if the measurement is low, the hardenability estimate is not unduly affected.

18-34. **Stamp for Marking Jominy Test Bar.** Howard B. Myers. *Metal Progess,* v. 47, Feb. '45, p. 273.

Rubber stamp to place ink lines 1/16 in. apart on the hardened Jominy specimen.

18-35. **Copper Plate as a Stop-Off When Nitriding.** W. V. Sternberger and E. R. Fahy. *Metal Progress,* v. 47, Feb. '45, v. pp. 278-279.

Various coatings used in the past for selective "stopping-off" against nitriding. Copper, deposited under controlled conditions to give a dense non-porous plate, is effective. Describes the tests made and gives a summary of other methods commonly used.

18-36. **Magnetic Measurement of the Hardenability of Carbon Toolsteels.** C. B. Post. *Metal Progress,* v. 47, Feb. '45, pp. 286-288.

Cone-shaped test piece for determining the hardenability of carbon toolsteels is reliable and has sufficient sensitivity for the testing of shallow hardenabilities.

18-37. **Refrigeration of Aluminum Alloys.** *Refrigerating Engineering,* v. 49, Feb. '45, Insert after page 148.

Heat treatable aluminum alloys; delaying age hardening; temperatures for delaying age hardening.

18-38. **A Note on the Relationship Between Preliminary Heat Treatment and Response to Nitriding of Some Ni-**

triding Steels. C. C. Hodgson and H. O. Waring. Iron and Steel Institute Advance Copy, Dec. '44, 16 pp.

In nitriding some chromium-bearing steels it has been found that the hardness of the case is influenced considerably by the preliminary heat treatment to which the steel has been subjected. This is particularly true of the pre-nitriding tempering treatment. Steels of the chromium-molybdenum and chromium-molybdenum-vanadium types are considerably affected. A chromium-molybdenum steel containing a notable amount of aluminum is scarcely affected at all in this respect. Details of the experimental work described and illustrated. 8 ref.

18-39. **The Influence of the Heat Treatment of Steel on the Damping Capacity at Low Stresses.** Leopold Frommer and A. Murray. Iron and Steel Institute Advance Copy, Dec. '44, 9 pp.

Electromagnetic method of inducing torsional oscillations in freely suspended cylindrical steel bars used for measurements of the damping capacity up to a maximum stress of 100 psi. Six specimens, each 3 in. in diameter and 3 ft. long, all from the same melt, with a composition normal to a 0.6% carbon steel. Measurements were made in the normalized, 830° C., oil quenched and the fully tempered conditions; by successive heat treatment these conditions were repeated. The measurements showed that the damping value was a characteristic property which varied for each condition and was reproduced through two heat treatment cycles. 7 ref.

18-40. **Heat Treatment of Aircraft Parts.** Gerald Eldridge Stedman. *Modern Machine Shop,* v. 17, Feb. '45, pp. 124-130, 132, 134.

Outline of the equipment and processes used in the heat treat department of the Kansas City Plant of North American Aviation, Inc.

18-41. **Shrinking and Hardening in One Operation.** Charles O. Herb. *Machinery,* v. 51, Feb. '45, pp. 137-141.

Practice followed by the American Car and Foundry Co. in the assembly of bulldozer tractor track rollers.

18-42. **Flame-Hardening Piston-Ring Grooves in Locomotive Pistons.** Stephen Smith. *Machinery,* v. 51, Feb. '45, pp. 161-162.

To reduce wear and prolong the life of steel piston-heads, a number of railroads are flame-hardening the walls of the piston-ring grooves or specifying that they be flame-hardened by the manufacturer. This operation is quite simple, and can be carried out with a minimum of equipment and set-up time by following standardized procedures.

18-43. **Isothermal Treatment of Pistol Parts.** Roy M. Ellis, *Iron Age,* v. 155, Feb. 8, '45, pp. 42-46.

"Austempering preferred" appears on many Ordnance drawings today. Those parts that cannot be made tougher or with greater impact strength by adding strengthening radii or by radical design changes,

can be austempered in the liquid bath to meet severe service conditions.

18-44. **Induction Heating Conference Discusses Trends, Techniques.** *Iron Age,* v. 155, Feb. 8, '45, pp. 58-61.

New applications developed for peacetime use of induction, dielectric heating, following mass production utilization in war material.

18-45. **The Brazing and Hardening of Hydraulic Equipment.** Gerald E. Stedman. *Industrial Gas,* v. 23, Jan. '45, pp. 7-8, 26-27.

Discusses Adel heat treating techniques which involve the use of industrial gas for brazing and hardening.

18-46. **Application of Controlled Atmospheres to the Processing of Metals. Part I.** C. E. Peck. *Western Metals,* v. 3, Jan. '45, pp. 9-12, 15.

Outlines the principal types of atmospheres, and describes briefly the equipment available for producing these atmospheres; summarizes the application of these various atmospheres to a wide variety of heat treating processes now in active commercial use.

18-47. **Sub-Zero Treatment of Steel Increases Hardness and Stability. Charles M. Parker.** *American Machinist,* v. 89, Feb. 15, '45, pp. 116-118.

A three to six-fold increase in pieces per grind is reported for high speed steel tools subjected to cold treatment. What happens to the internal structure of the metal to bring about such worth-while results explained.

18-48. **Heat Treating Tubing Continuously.** Irwin H. Such. *Steel,* v. 116, Feb. 12, '45, pp. 94-95.

Method for applying continuous induction heating in annealing stainless steel tubing. Machine also used for heat treating other types of alloy steel, such as SAE 4130 and NE 8630. These steels may be quenched in oil after emerging from the heating coil without danger of fire.

18-49. **New Equipment—Heat Treating and Furnace Control.** *Iron Age,* v. 155, Feb. 15, '45, pp. 76-78.

Recent developments in heat treating furnaces, induction heating equipment and process control and testing machines are described.

18-50. **Bright Annealing Brass.** *Steel,* v. 116, Feb. 19, '45, pp. 130, 133.

Longest continuous conveyor-type salt bath furnaces full anneal 6000 lb. of brass cartridge cases per hour with unequalled absence of oxidation.

18-51. **Interrupted Quench in a Recirculating Air Draw Furnace.** J. L. Foster. *Industrial Gas,* v. 23, Feb. '45, pp. 12-14.

Basis of this article is to establish the proper heat treatment of various splined shafts made from SAE 4150 steel. (Paper presented before Midwest Industrial Gas Council, Peoria, Ill.)

18-52. **Induction Heating.** G. W. Birdsall. *Steel,* v. 116, Feb. 26, '45, pp. 80-81, 112, 114, 116.

Does important processing work. Cuts heat treating cycles from hours to seconds; enables heat treating to be done right at production line by girls who require no special training for the work; combines heat treating with shrink fitting on certain assemblies.

18-53. **Induction Heating of Internal Surfaces in the Automotive Industry.** Howard E. Somes. *Steel Processing,* v. 31, Feb. '45, pp. 90-96, 130.

Covers one specific field of induction heat treating, i.e., the treatment of internal diameters. Here, a zone of relatively shallow depth, commencing at the bore of a hollow body and extending outward radially, is to be heated so rapidly as to be confined to but a portion of the work piece and then at the required time quenched. Hardness; case thickness; stresses; D/T ratio; the machine; new applications; cylinder sleeves; dry cylinder liners; hubs; integral bearing cages; bearing race application; axle ends; internal gears; internal splines; grease retainer recesses; hydraulic cylinders.

18-54. **High-Frequency Heating of Conductors and Non-Conductors.** R. M. Baker and C. J. Madsen. *Electrical Engineering,* v. 64, Feb. '45, pp. 50-57.

Theories of induction heating of metallic electric conductors and of dielectric heating of non-metallic non-conductors are discussed in simple terms for the benefit of those who are not specialists in this field. The various types of high frequency heating, its applications to industry, and its advantages in economy, efficiency, speed, and adaptability are pointed out. 14 ref.

18-55. **Fundamental Principles and Applications of Induction Heating, V.** *Sheet Metal Industries,* v. 21, Feb. '45, pp. 293-297, 310.

Continuous hardening of bars; megacycle hardening. 10 ref.

18-56. **Sub-Zero Treatment of Steel.** H. C. A. *Machinery* (London), v. 66, Jan. 11, '45, pp. 29-34.

Presentation of the fundamentals of cooling hardened steels to temperatures considerably below room temperature, properly correlated with the basic treatment cycle and related structural changes. 11 ref.

18-57. **This Heat-Treatment Business.** A. J. K. Honeyman. *Metal Treatment,* v. 11, Winter '44-'45, pp. 207-212.

Devices which are widely discussed and less widely employed in order to improve the properties of heat-treated steels. Boron additions; timed quenching, martempering, austempering and subzero cooling.

18-58. **Induction Heating Cycles.** W. E. Benninghoff and H. B. Osborn. *Canadian Metals & Metallurgical Industries,* v. 8, Feb. '45, pp. 32-37, 40.

Selection of frequency and time for processing of metallic parts. 5 ref.

18-59. **AC Spark Plug Construction of Machine Guns Involves Numerous Heat Treatments.** *Industrial Heating,* v. 12, Feb. '45, pp. 207-208, 210, 212, 214, 216, 218, 220.

Discusses some of the methods used in processing specific parts of the .50 caliber Browning machine gun, as well as the equipment used in production hardening, carburizing, and similar operations.

18-60. **The Tempering of Steel.** *Industrial Heating,* v. 12, Feb. '45, pp. 242, 244, 246.

Structural changes during the tempering of high carbon steel, the effect of carbon on the tempering of steel, the tempering of nickel and nickel-molybdenum steels, and the effect of quenching bath temperature on the tempering of high speed steel.

18-61. **Queen City Steel Treating Company Plant Features Modernized Production Set-Up: II.** *Industrial Heating,* v. 12, Feb. '45, pp. 310, 312, 314, 316.

Cleaning equipment, brazing facilities and straightening, testing and inspection equipment described, along with the furnaces and related units in Plant No. 2, which is engaged primarily in nitriding operations along with some heat treatment of non-ferrous alloys.

18-62. **Alloy Steels.** *Iron & Steel,* v. 18, Jan. '45, pp. 33-35.

Producer gas-fired installation for heat treating bars and sections.

18-63. **Fundamental Principles and Applications of Induction Heating.** "Heat Treater." *Sheet Metal Industries,* v. 21, Jan. '45, pp. 111-115.

Part V—Induction hardening. Heat treatment of gears; accurate specification of steel necessary; applications in the motor-car industry.

18-64. **A Producer-Gas Fired Heat Treatment Furnace Installation for Alloy and Special Steel Bars.** *Sheet Metal Industries,* v. 21, Jan. '45, pp. 126-128.

Quenching; electrically operated charging machine; electrical controls.

18-65. **Tooling for Induction Heating.** Frank W. Curtis. *Tool Engineer,* v. 14, Feb. '45, pp. 18-24.

This ultra modern technique, though still in its infancy, effects marked economies in mass production and promises to revolutionize the manufacture of complex parts.

18-66. **Continuous Heat Treatment.** Harry W. Smith. *Iron Age,* v. 155, March 8, '45, pp. 58-63.

The development of all-ceramic burners handling high-pressure carbureted gas-air-mixtures has opened new vistas in heat treatment. High speed, automatic continuous units, clean and very compact, are being developed for bar and strip stock in both ferrous and non-ferrous industries.

18-67. **Electronic Heating of Metals and Non-Metallic Materials.** Holbrook L. Horton. *Machinery,* v. 51, March '45, pp. 147-155.

Considers briefly ways in which induction and di-

electric heating are produced; ways in which electronic devices can be applied in the mechanical field.

18-68. **Megacycle Induction Heating.** Vernon W. Sherman. *Steel,* v. 116, March 12, '45, pp. 116, 158, 160, 162, 164, 167.

Frequencies of 2,000,000 to 5,000,000 cycles per second are used in rapidly producing hardened cases ranging from 0.003 to 0.030 in. in depth without altering the heat treating benefits of previously toughened core. Process may be used to heat treat sorbitic steels to duplicate results of sub-zero treatments, says author in report also presented before the Electro-chemical Society.

18-69. **Heat Treating Armor Plate at Ford Rouge Plant.** *Industrial Heating,* v. 12, March '45, pp. 383-386, 388, 390, 392, 394-396, 398, 400.

Five production lines installed, one of which is described.

18-70. **Heat Treatment of Broaches Requires Specialized Equipment and Technique.** *Industrial Heating,* v. 12, March '45, pp. 410, 412, 414, 416, 418.

Heat treating department; vertical furnaces; horizontal heat treating furnaces; salt bath equipment; accessories and auxiliary equipment; heat treating procedures; laboratory facilities.

18-71. **Sub-Atmospheric Treatment and Sodium Cyaniding of Tool Steels.** *Industrial Heating,* v. 12, March '45, pp. 420, 422, 426.

Sub-atmospheric transformation of retained austenite; sub-zero treatment of Mo-W high speed steel.

18-72. **Perfection Plant in Chicago Features Special Processes for Treating Tools.** *Industrial Heating,* v. 12, March '45, pp. 489-492, 494, 496, 498-500.

Description of plant and equipment.

18-73. **Cold Treatment in Gage Stabilization.** Charles T. Post. *Iron Age,* v. 155, March 15, '44, pp. 52-54.

Six cooling cycles at —120° F., each followed by tempering, complete austenite-martensite transformation to stabilize gage blocks. This treatment, along with the new Bureau of Standards test, has greatly accelerated production.

18-74. **Simultaneous Hardening and Tempering.** Stephen Smith. *Machine Design,* v. 17, March '45, pp. 157-158.

Established metallurgical principles of heat treating practice, such as heating the surface above the critical temperature, quenching with a suitable medium, and tempering or reheating to the proper temperature to produce the desired degree of surface hardness, are incorporated in a new process of simultaneous flame hardening and tempering. The technique really combines heating, quenching and tempering into a single, progressive operation.

18-75. **Application of Controlled Atmospheres to the Processing of Metals, II.** C. E. Peck. *Western Metals,* v. 3, Feb. '45, pp. 10-12, 15-16.

Auxiliary equipment for drying atmosphere gases; furnace equipment to be used with controlled atmosphere; annealing (non-ferrous metals); hardening of ferrous metals; gas carburizing; atmosphere furnace brazing non-ferrous metals; ferrous metal brazing; sintering or powder metallurgy applications.

18-76. **Gases for Heat Treating Purposes.** *Machinery,* v. 51, March '45, pp. 162-163.

Gases referred to are known by various trade names and are used for different purposes, according to whether the mixtures are lean or rich. Applications of each are briefly referred to.

18-77. **Induction Heating.** Frank T. Chesnut. *Iron Age,* v. 155, March 22, '45, pp. 46-53.

Growth of applications by the pioneer company in the field is traced and future possibilities pointed out.

18-78. **Fundamental Principles and Applications of Induction Heating.** *Sheet Metal Industries,* v. 21, March '45, pp. 489-493.

Internal hardening and assembly processes.

18-79. **Normalizing Versus Stress-Relieving.** O. Schmidt and E. Jollenbeck. *Welding Journal,* v. 24, March '45, pp. 185s-192s.

Metallurgical considerations; mechanical characteristics.

18-80. **Sub-Zero Treatment of Steels.** H. C. Amtsberg. *Tool & Die Journal,* v. 10, March '45, pp. 101-103, 110-114.

Presentation of the fundamentals of cooling hardened steels to temperatures considerably below room temperature properly correlated with the basic treatment cycle and related structural changes. 11 ref.

18-81. **Some Metallurgical Principles for the Efficient Heat Treatment of Steel.** Arthur Dube and S. L. Gertsman. *Canadian Mining & Metallurgical Bulletin,* no. 395, March '45, pp. 165-183.

Developments of last 15 years by metallurgical research in the field of heat treatment of steels. Practical aspects of these developments emphasized. Methods of representation of the phase change during austenitizing and sub-critical transformation of austenite described and importance of time-temperature-transformation charts for the planning of heat treatment cycles.

18-82. **Heat Treating High Speed Steels.** H. E. Lewis. *Steel Processing,* v. 31, March '45, pp. 159-163, 186-187.

Types of high speed steels; tools and dies; heat treating temperatures and process; sub-zero treatment; cyanide nitriding; equipment required for heat treating high speed steel; furnace operations; installation; forging.

18-83. **Heat Treatment of Magnesium Alloys.** D. Burks, R. F. Thomson and W. E. Jominy. *Foundry,* v. 73, April '45, pp. 100-103, 236, 238.

Data on the effect of pouring temperature, initial structure, heating rate prior to solution treating, solu-

tion temperature, solution time, cooling rate from the solution temperature, aging temperature and aging time on resultant static physical properties and microstructure of fine grained 6% aluminum, 3% zinc alloys. A brief study of dimensional changes during heat treatment is included. 1 ref.

18-84. **ABC's of High Frequency Heating.** Willard M. Woll. *Industry and Power,* v. 48, April '45, pp. 66-67.

Elementary facts as well as up-to-date information on developments in induction and dielectric heating.

18-85. **The Rate of Spheroidization and the Physical Properties of Pearlitic Malleable Iron After Isothermal Quenching.** Walter H. Bruckner and Jun Hino. American Foundrymen's Association *Transactions,* v. 52, June 45, pp. 1189-1216.

Investigations made on the feasibility of reducing the heating cycle required for spheroidization of malleable iron. The investigations included isothermal quenching at temperatures of 1200, 1100, 1000, 900, and 600° F. Photomicrographs are included to show the malleable irons investigated "as received," as isothermally quenched and at various stages of spheroidization.

18-86. **Sub-Zero Treatment of Steels.** H. C. Amtsberg. *Metallurgia,* v. 31, Feb. '45, pp. 165-168.

Fundamentals of cooling hardened steels to temperatures considerably below room temperature properly correlated with the basic treatment cycle and related structural changes.

18-87. **Engineering Properties of Heat Treated Cast Irons.** J. S. Vanick. *American Foundryman,* v. 7, April '45, pp. 11-15.

Simplifies the description of heat treating processes, and contrasts "as cast" with "heat treated" in as simple a comparison as possible.

18-88. **Atmosphere Applications — Equipment, Methods and Process Cycles.** Floyd E. Harris. *Metal Progress,* v. 47, April '45, pp. 713-723.

Equipment, operating factors and actual cycles. Principles of equipment and operation: Carburizing; carburizing and diffusion; replacement of surface carbon on decarburized bars; oxide coatings. Manner of correlating this supply and demand commercially.

18-89. **An Annealing Department Laid Out for Efficiency.** R. K. Weyant. *Wire and Wire Products,* v. 20, April '45, pp. 265-269, 303.

New wire annealing department of the Wilson Steel and Wire Co., Chicago, describing the latest improvements together with a plant layout designed for highest efficiency.

18-90. **Heat Treating Stainless Steels.** *Steel,* v. 116, April 16, '45, pp. 112-116, 118, 120, 160, 162.

Data presented on the correct procedure for heat treating stainless steels, results of research and long practical experience of the metallurgists of the Rustless Iron and Steel Corp. User of these steels is provided

with a ready guide for preparing them to take full advantage of their corrosion resistant and mechanical properties.

18-91. **Protective Atmospheres Meet Broad Needs.** *Production Engineering and Management,* v. 15, April '45, p. 99.

Heat treating experience in wartime use of protective gases points to future applications which will permit development of lighter, tougher parts in auto and plane engines. Another field to benefit from advances made today will be powder metallurgy.

18-92. **Influence of Tempering Temperatures Upon the Strength of Heat Treated Steels.** D. W. Rudorff. *Metallurgia,* v. 31, March '45, pp. 237-240.

By the proper heat treatment of steels it is possible to obtain a combination of properties; thus, tempering a hardened steel will increase its toughness at the expense of the hardness property, but the tempering temperature is known to have considerable influence on the strength of steels. This review of an investigation on the subject deals with results of tests on two carbon steels and two low-alloy steels.

18-93. **Metallurgical Control of Shaved Aircraft Gears.** R. E. Liebendorfer. *Iron Age,* v. 155, April 19, '45, pp. 56-61.

Discusses the heat treatment of the gears, with particular emphasis on carburizing practice. Since the gear teeth are not touched after hardening, it is essential that decarburization be avoided during hardening. Radically new methods have been devised to measure and control the amount of decarburization that might take place in thin surface layers.

18-94. **Spheroidizing Cycles Standardized.** H. L. Hopkins. *Iron Age,* v. 155, April 19, '45, pp. 72-75.

By correlating a series of tests, the proper annealing temperatures for six types of steels have been determined within very narrow temperature ranges. This has resulted in man-hour and fuel savings and a consistently higher quality product.

18-95. **Fundamental Principles and Applications of Induction Heating.** *Sheet Metal Industries,* v. 21, April '45, pp. 651-657, 681.

Internal hardening and assembly processes. 10 ref.

18-96. **Heat Treatment of Steel.** *Canadian Metals & Metallurgical Industries,* v. 8, April '45, pp. 20-27.

Metallurgical principles involved in efficient operations: Austenitizing; transformation of austenite; normalizing; full annealing; isothermal annealing and spheroidizing; hardening; retained austenite; internal stresses. 53 ref.

18-97. **Sub-Zero Treatment of Steels.** H. C. Amtsberg. *Canadian Metals & Metallurgical Industries,* v. 8, April '45, pp. 33-36.

Presentation of the fundamentals of cooling hardened steels to temperatures considerably below room

temperature, properly correlated with the basis treatment cycle and related structural changes. 11 ref.

18-98. **Heat Treating 18-8 Stainless in Salt Baths.** Keith Whitcomb. *Iron Age,* v. 155, April 26, '45, pp. 48-52.

Investigation for a suitable molten salt bath to be operated at a high temperature for the annealing of welded 18-8 stainless steel and the removal of welding flux, has resulted in the selection of pure sodium carbonate which has great stability, ease of operation and from an economic standpoint is eminently satisfactory over a variety of the barium chloride types.

18-99. **Age-Hardenable Beryllium-Copper.** *Wire Industry,* v. 12, April '45, pp. 195-197.

Recommended treatment in wire form. Heat treatment; oxidation dangers; close pyrometric control essential.

18-100. **Experiments Reveal Versatility of High Frequency Heating.** E. D. Tillson. *Industry & Power,* v. 48, May '45, pp. 64-66.

Tests conducted with over 200 different materials indicate that induction and dielectric heating are worthy of industry's closest attention and study.

18-101. **Continuous Heat Treatment of Shells.** D. E. Wyman. *Metals & Alloys,* v. 21, April '45, pp. 1009-1012.

Interesting practice and modern equipment used by one manufacturer for shell hardening and tempering.

18-102. **Heat Treating High Speed Steels.** H. E. Lewis. *Steel Processing,* v. 31, April '45, pp. 222-228.

Flame curtain; flame curtain adjustment; loading; quenching; atmosphere requirements to prevent decarburization; testing.

18-103. **Heat Treating Aluminum Alloys.** Carl L. Goodwin. *Light Metal Age,* v. 3, April '45, pp. 16-19, 32, 36-37.

Discusses the changes that take place in the physical structure of aluminum alloys under different forms of heat treatment, the reasons for different heat treatments, and types of equipment for best results.

18-104. **Controlled Spheroidization of Pearlitic Malleable Iron.** C. R. Wiggins. *Iron Age,* v. 155, May 10, '45, pp. 78-81.

To correct some misimpressions of the mechanism of short cycle malleabilization, the practice in the production of Z-Metal reviewed. Spheroidization chart presented that could serve as a standard of spheroid particle size for other ferrous materials, such as steels.

18-105. **Spheroidizing.** J. G. Ritchie. *Australian Institute of Metals: Australasian Engineer,* v. 44, Nov. 7, '44, pp. 25-35. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 127-A.

A short explanation of the term spheroidizing is given and the means by which a spheroidized structure can be obtained are pointed out. These include: (1) Subcritical annealing, which is largely a slow diffusion process, carried out to increase the ductility of medium carbon steels. The time required is extremely long,

but can be shortened by a hardening pretreatment. Spheroidization is also accelerated by previous cold work. (2) Spheroidizing by transformation of austenite to spheroidite. Low carbon steels show a tendency to transform to pearlite rather than to spheroidite if the austenitizing temperature is raised too far above the Ac_1 point. Slow cooling cycles for plain carbon tool steels are described in detail. (3) Spheroidizing by isothermal transformation, where the sub-critical temperature must be not more than 45° C. below the Ac_1 point in order to obtain a spheroidal product. These methods can also be applied successfully to alloy steels. The elimination of decarburization constitutes a difficult problem in this treatment. A certain amount of graphitization of cementite often occurs. Spheroidizing is carried out to improve cold working properties, machinability, and the structure after a final hardening. Some of the faulty structures likely to be produced are also discussed. 34 ref.

18-106. **The Isothermal Transformation of Alloy Tool Steel.** A. N. Alimov, N. N. Lipchin and N. F. Sivkov. *Katshestvennaia Stal,* no. 2, 1937, pp. 37-40. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 127-A.

An account of tests made on alloy steels for forging into tools with a view to reducing the time required for heat treatment. The five steels used were: (1) A 12% chromium steel; (2) a low alloy chromium-nickel-molybdenum steel; (3) a 1.20% chromium, 1.70% tungsten steel; (4) an 8.40% tungsten, 2.53% chromium, 0.33% vanadium steel; and (5) a 17.5% tungsten, 3.90% chromium steel. Satisfactory heat treatments were developed which involved holding at 860 to 900° C. for 1 to 1½ hr. followed by holding at a subcritical temperature for not more than 4 hr. The total heat treatment time was reduced by about 60% as compared with the former methods.

18-107. **The Selection of a Quenching Oil for Hardening Steel.** H. Krainer and K. Swoboda. *Archiv für das Eisenhüttenwesen,* v. 17, Jan.-Feb., '44, pp. 163-169. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 128-A.

A. Rose has previously constructed characteristic curves for different quenching media which depict the changes in cooling velocity at the center of a silver ball when quenched from 800° C. (see Iron & Steel Institute *Journal,* 1939, no. II, p. 272-A.) In the present paper, experiments are reported in which the cooling rates at the center of steel plates from 25 to 200 mm. thick when quenched in different oils and in water were first calculated using Rose's curves, and then checked by making hardness determinations and examining the microstructure of the quenched steels. The steels used included a chromium-molybdenum steel, a chromium-vanadium steel and two chromium-manganese steels. The calculated and experimental results were in good agreement.

18-108. **Heat Treating Stainless Steels.** *Steel,* v. 116, April 23, '45, pp. 88-89.

Covers straight chromium and chromium-nickel non-hardenable grades.

18-109. **Danger of Failure in Welded Structures Greatly Reduced by Low-Temperature Stress Relief.** T. W. Greene and A. A. Holzbaur. *Steel*, v. 116, April 23, '45, pp. 110, 142, 144.

Low cost, non-detrimental application of heat ranging from 350 to 400° F. relieves both longitudinal and transverse stresses. Minimum yield point value affords durability and safety in shipbuilding.

18-110. **Induction Heating of Moving Magnetic Strip.** R. M. Baker. *Electrical Engineering*, v. 64, April '45, pp. 184-189.

General problem of heating iron or steel strip by induction is analyzed to arrive at equations for power-factor efficiency and density of heating under all conditions. Certain general curves are shown to illustrate the limitations of strip thickness, frequency, and density of heating. 3 ref.

18-111. **Hardening and Shrink Fitting.** *Steel*, v. 116, April 30, '45, pp. 92-93, 128, 130.

Operations are performed simultaneously with induction heating in assembling 3-piece track rollers.

18-112. **Stress Relief of Weldments for Machining Stability.** J. R. Stitt. *Machine Design*, v. 17, May '45, pp. 113-114.

Determining the quantitative effect of temperature on the degree of stress relief obtained.

18-113. **Measurement of Case Depths by Martensite Formation.** E. S. Rowland and S. R. Lyle. *Metal Progress*, v. 47, May '45, pp. 907-912.

Accurate method to measure the depth to the 0.40 to 0.50% carbon level on hardened microsections.

18-114. **Gas Furnaces for Interrupted Quenching.** A. H. Koch. *Metal Progress*, v. 47, May '45, pp. 921-925.

Steel must be heated to and held at a temperature above its upper critical long enough to transform and diffuse it into an austenitic structure as homogeneous as practically possible. For proper and uniform response to any rapid cooling the austenite must be uniform. The time required for the transformation of austenite to start, and to be completed, is dependent upon the analysis of the steel and the temperature at which the steel is held. Use of salt baths, lead hardening furnaces, and controlled atmosphere furnaces. Salt quench furnace.

18-115. **Quenching Oils.** Blaine B. Wescott and L. W. Vollmer. *Metal Progress*, v. 47, May '45, pp. 935-936.

Takes issue with some of Metallurgicus's opinions on quenching oils.

18-116. **Preserving the Corrosion Resistance of Stainless Steel During Annealing or Heat Treatment.** G. C. Kiefer. *Corrosion and Material Protection*, v. 2, May '45, pp. 10-14.

Preparation and maintenance of surface prior to

and during annealing are of utmost importance. It is essential to provide a final surface conditioning after all fabricating is finished. Final conditioning may be greatly facilitated by the amount of attention given the metal surface during the annealing operation. Imperative that both surface conditioning and proper annealing procedures receive careful attention. Surface conditioning; furnace conditions; annealing table shown.

18-117. **Changes in Metal Surfaces Through Cavitation.** Max Vater. *Zeitschrift für Metallkunde,* v. 26, Feb. '44, pp. 38-43.

18-118. **Changes in Volume and Electrical Resistance During the Heat Treatment of Copper-Beryllium Alloys.** Hans Thomas. *Zeitschrift für Metallkunde,* v. 36, June '44, pp. 136-140.

18-119. **Carburization and Decarburization of Steel.** *Western Metals,* v. 3, May '45, p. 36.

"No-Carb" and "No-Kase" products of considerable assistance in selective carburization and the prevention of decarburization.

18-120. **Hardening "Moly" Hacksaw Blades.** G. W. Birdsall. *Steel,* v. 116, May 21, '45, pp. 109-110.

Improved protective atmospheres avoid decarburization. Description of furnace and atmosphere generating equipment used to harden these molybdenum hacksaw blades without scaling or decarburization finds the main point of departure in the cracking unit which employs special materials along with a catalyzing agent.

18-121. **Effect of Delayed Quench on the Strength of Alclad 24S-T Sheet.** J. E. Douglas. *Iron Age,* v. 155, May 24, '45, pp. 62-63.

Tests indicate that when solution heat treating 0.032-in. Alclad 24S-O sheet at the soaking temperature of 920° F., maximum strength is obtained if the material is soaked for a period of 20 min. and quenched in the shortest possible time. Tensile, yield and ultimate strength, and in general per cent elongation, decrease with increase in quench delay for any given soaking period.

18-122. **Heat Treatment of Steel as Related to Design, Materials and Processing.** Thomas F. O'Brien. *Metals and Alloys,* v. 21, May '45, pp. 1335-1350.

The problem; design; materials engineering; general processing and heat treatment; progress in methods and equipment; the personal equation. 33 ref.

18-123. **Methods for the Quenching of Steel, Part V.** M. H. Mawhinney. *Industrial Heating,* v. 12, May '45, pp. 760, 762, 764, 766, 768, 770.

Continuous quenching.

18-124. **Heat Treating and Finishing of Light Alloys in Wright Aeronautical Plants, II.** H. E. Linsley. *Industrial Heating,* v. 12, May '45, pp. 823-830, 832.

Describes ovens used in processing aluminum alloy

parts, as for heat treating, shrink fitting, paint baking, etc.

18-125. **Nutmeg Heat Treating Co. Facilities Handle All Types of Commercial Work.** *Industrial Heating*, v. 12, May '45, pp. 850-852, 854, 856, 858.

Ferrous and non-ferrous metals are processed by induction heat treatment, flame hardening, annealing, hardening, cyaniding, air tempering, carburizing, normalizing and tool hardening.

18-126. **Maximum Carbon in Carburized Cases.** Sidney Breitbart. *Metal Progress*, v. 47, June '45, pp. 1121-1127.

Theoretical considerations indicate that the maximum carbon in a carburized case should be no higher than the A_{cm} point for the carburizing temperature, but much higher carbons are frequently found in practical operation. This discrepancy is explained by relating excess carbides in the case to the undiffused complex carbides or carbide nuclei in the steel during the carburization; undesirable surface carbides can be avoided if the steel is first converted to truly homogeneous austenite.

18-127. **Heat Treatment of R301 Alloy.** T. L. Fritzlen and L. F. Mondolfo. *Metal Progress*, v. 47, June '45, pp. 1128-1136.

Covers heat treatment of R301 in detail; response to numerous requests for additional information on the heat treating practices and their effect on the properties.

18-128. **Individual Oil Quenches for Machine Parts.** A. R. Hotchkiss. *Steel*, v. 116, June 4, '45, pp. 122, 156.

By the pressure quench method, the advantages of a mild quenching medium are retained, more desirable physical properties are secured, a single operation setup replaces a more complicated one, and increased production is secured.

18-129. **Contour Hardening Steel Gear Teeth.** V. W. Sherman. *Steel*, v. 116, May 28, '45, p. 130.

Uniform, thin-case contour hardening of steel gear teeth, by the application of high frequency energy in the megacycle range.

18-130. **Salt Baths in the Wire Industry.** A. R. Stargardter. *Wire and Wire Products*, v. 20, June '45, pp. 415-419, 448-450.

Development of salt bath furnaces; equipment requisites; typical installations; cyclic annealing; descaling.

18-131. **Fundamental Principles and Applications of Induction Heating, VII.** *Sheet Metal Industries*, v. 21, May '45, pp. 837-843.

Bright flowing of electrolytic tin plate: Paint and lacquer drying; forging; heating of a mass; annealing and normalizing. 3 ref.

18-132. **Heat Treatment of Tank Track Spindles.** A. R. Page. *Machinist*, v. 88, Feb. 10, '45, pp. 281-283; Feb. 17, '45, pp. 287-288. Iron and Steel Institute *Bulletin*, no. 112, April '45, p. 153-A.

18-133. Sub-Zero Treatment Improves Tool Life of High Speed Tools. T. M. Snyder. *Machinist,* v. 88, March 3, '45, pp. 91-93. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 154-A.

18-134. Localized Annealing and Hardening. John E. Hyler. *Steel,* v. 116, June 11, '45, pp. 134, 136, 180, 182, 184.

Specialized machines for application of heat to certain areas of parts requiring treatment for protection against wear or to help retain or increase softness are described. Employing gas or electricity, these units are remarkably adaptable for production line operations. 6 ref.

18-135. Heat Treatment of Light Metals. *Light Metal Age,* v. 3, May '45, pp. 21, 37-38.

A bibliography.

18-136. Beryllium-Copper — a Heat Treatable Alloy. M. J. Donachie. *Modern Metals,* v. 1, June '45, pp. 8-12.

Beryllium-copper, as a heat treatable alloy, has had a somewhat varied success due to a lack of uniformity in the material from the casting stage through the heat treating to the final stock. Difficulties in making proper ingots and their heat treatment which are responsible for the non-uniform physical properties and points out methods of prevention. 7 ref.

18-137. A Survey of Dielectric Heating. M. J. Maiers. *Electrical Engineering,* v. 64, June '45, pp. 210-211.

Materials that are poor conductors of electricity may be treated electrically by subjecting them to electrostatic fields that reverse at rates from 3 to 30 megacycles per second. The applications made so far of this form of heating promise new, improved products in the future.

18-138. Some Aspects of the Hardening and Hardenability of Steel. *Metal Treatment,* v. 12, Spring '45, pp. 23-28, 22.

Quench-hardening of steel has become a scientifically controlled operation. Hardening temperature specified can be accurately measured; troubles like scaling (oxidation) and the formation of a soft decarburized skin may be prevented by using a controlled furnace atmosphere or by heating tools in a bath of molten salt or in charcoal. Some aspects of the subject discussed. 6 ref.

18-139. Isothermic Heat Treatment of Steel. Harold J. Babcock. *Metal Treatment,* v. 12, Spring '45, pp. 29-37.

Basic principles underlying isothermal transformation, which is the transformation of steel at a constant elevated temperature as distinct from the change effected by quenching to room temperature and reheating. Practical utilization of the treatment is in such processes as "Martempering" and "Austempering." 8 ref.

18-140. Carbonaceous Muffle Method of Atmosphere Control for Hardening High Speed Steel. E. F. Watson. *Metal Treatment,* v. 12, Spring '45, pp. 39-42.

Carbon block method of hardening high speed steel to avoid decarburization, scale or excessive carburization.

18-141. **Salt Baths and Their Hazards.** E. G. West. *Metal Treatment,* v. 12, Spring '45, pp. 49-55.

Discusses fire risk associated with salt baths, which are used principally for the heat treatment of the light aluminum alloys.

18-142. **Induction Heating Speeds Helldiver Production.** E. K. Fry. *Aviation,* v. 44, June '45, pp. 138-140.

Details of a processing method which has done the trick on numerous brazing, production, and salvage jobs—to improve quality and expedite output of small parts for C-W Helldivers.

18-143. **Methods for the Quenching of Steel.** M. H. Mawhinney. *Industrial Heating,* v. 12, June '45, pp. 954, 956, 958, 960, 962.

Fixture and high-temperature quenching.

18-144. **Isothermal Transformation, End-Quench Hardenability and Tempering of Steels.** *Industrial Heating,* v. 12, June '45, pp. 964, 966, 968.

Tempering cobalt steels; isothermal transformation and hardenability of NE steels; new hardenability test procedure; hardenability test for low carbon steels and shallow hardening steels.

18-145. **Heat Treating Aluminum Alloy Aircraft Parts in High Speed Production Units.** *Industrial Heating,* v. 12, June '45, pp. 970, 972, 974, 976.

With this equipment, a work load of 1200 lb. of aluminum alloy can be heated from 70 to 930° F. within 25 min. if the furnace is already stabilized at this latter temperature before the load is conveyed into the heating chamber. Unusual features.

18-146. **Clean or Bright Annealing Furnace for Non-Ferrous Products.** *Industrial Heating,* v. 12, June '45, p. 982.

New furnace in which coils of silver-solder wire are clean annealed in an open-fired chamber without the need for muffles or external atmosphere-generating units. Desired atmosphere in the furnace is accurately controlled from the gas-proportioning equipment which regulates the air-gas supply to the burners.

18-147. **Miniature Elevator.** A. R. Hotchkiss. *Steel,* v. 116, June 18, '45, p. 107.

Affords precise movement through inductor block in induction hardening, ends loss of parts by arcing, produces more uniformly treated work.

18-148. **Result of Stabilizing Heat Treatment on Welded 18-8 Stainless.** Wilson G. Hubbell. *Iron Age,* v. 155, June 21, '45, pp. 56-60.

Tests carried out indicate that stabilizing treatment obtained by heating welded sections of 18-8 types 321 and 347 stainless steel for 30 min. at 1650° F. exerts some small, but inconclusively beneficial results in helping the metal resist corrosive aqueous solutions

and electrolytes (Strauss test). There appears to be no justification that this type of heat treatment increases the resistance of aircraft engine exhaust manifolds to intergranular attack by exhaust gases at elevated temperatures.

18-149. **Stress Relief of Weldments for Machining Stability.** J. R. Stitt. *Welding Journal,* v. 24, June '45, pp. 331s-349s.

Determines the effect of thermal stress relief treatments, having maximum temperatures of 900, 1000, 1100, 1200, 1300 and 1400° F., upon the stabilities of weldments during machining operations. Specimens used throughout this investigation were made from four high-tensile steels; namely, NE 8630, SAE 4130, NAX-X 9115 and NAX-X 9130.

18-150. **Thermal Lag in Heat Treatment Operations, With Particular Reference to the Annealing of Malleable Cast Iron.** A. E. Peace. *Foundry Trade Journal,* v. 76, May 24, '45, pp. 67-72.

Factors which are not usually given sufficient consideration; heat transfer; convection; radiation; heat capacity; thermal lag; practical examples; shape and size of annealing pots; types of heat treatment furnaces. 9 ref.

18-151. **Sub-Zero Treatment.** *Automobile Engineer,* v. 35, May '45, pp. 199-202.

Introduction of a sub-zero cooling into the heat treatment cycle has a beneficial effect on many steels. Cycles for various classes of steels are discussed and reference is made to the use of the sub-zero process for expediting stabilization of high precision components such as gage blocks.

18-152. **Metallography of Aluminum Alloys as a Shop Control.** S. H. Phillips. *Light Metal Age,* v. 3, June '45, pp. 8-11, 28.

Illustrates and discusses manner in which proper metallographic examination reveals different types of faulty heat treatments of commercial aircraft aluminum alloys.

18-153. **Improved Quenching.** C. G. Purnell and H. M. Pfahl. *Steel,* v. 117, July 2, '45, pp. 88-91, 127.

Produces parts with higher tensile and yield strengths as well as materially increased toughness. Purnell process features strongly agitated quench bath; increased speed of quenching action; precisely timed quench, producing exact end temperature; immediate tempering. Distortion is controlled; machinability increased.

18-154. **Annealing Malleable Iron.** J. E. Rehder. *Canadian Metals & Metallurgical Industries,* v. 8, June '45, pp. 29-34.

Principles and practice; special processes; annealing cycles.

18-155. **Effects of Highspeed Air-Gas Heat on Metals.** *Western Metals,* v. 3, June '45, p. 23.

Major advantages listed.

18-156. **Heat Treatment of Stainless Steel for Exhaust Manifolds.** Wilson G. Hubbell. *Aero Digest,* v. 50, July 1, '45, pp. 98, 100, 103-104, 163.

Effect of stabilizing and stress relief heat treatments upon welded 18-8 stainless steel. Tests were designed to determine the particular benefits, if any, which might be imparted by these processes to types 321 and 347 of the 18-8 stainless steels for use in exhaust manifolds.

18-157. **Probable Postwar Trends in Heat Treatment.** A. Glynne Lobley. *Metallurgia,* v. 32, May '45, pp. 15-19.

Many types of furnaces are of such a high order that they may be regarded as precision tools and can be operated successfully in the line of production. In dealing with postwar trends, special attention is given to this aspect of heat treatment and a few types of continuous furnaces are cited. Increase in the use of gas carburizing and heat treatment by induction heating comes in for special reference.

18-158. **Some Factors Connected with the Heat Treatment of Magnesium Alloys.** F. A. Fox. *Metallurgia,* v. 32, May '45, pp. 20-23.

To make the best possible use of the magnesium alloys it is necessary to be familiar with those whose properties can be improved by heat treatment and with the treatment which will give the desired result. A number of these alloys have been used to a great extent during recent years and have become familiar to engineers, but many factors associated with their heat treatment are still imperfectly understood; some of these are briefly discussed.

18-159. **Hard Surfaces on Steel by Induction Heating.** J. L. Aston. *Metallurgia,* v. 32, May '45, pp. 24-30.

High frequency induction heating has been applied to the heat treatment of parts during recent years. The rapidity of heating and the small floor space necessary make this form of heating especially applicable for use in main production shops. Induction heating is applied for surface hardening or a lower rate of heating is applied so that the part treated may be heated throughout. Progress in this branch of heat treatment in its application to the production of hardened surfaces is reviewed.

18-160. **Heat Treating and Refrigerating Aluminum Alloy Rivets for Martin Planes.** Harry F. Vollmer. *Machinery,* v. 51, July '45, pp. 154-161.

Rivet handling system that insures efficient use of heat treated rivets and reclamation of all types from floor sweepings.

18-161. **Metallurgy of SAE 52100 Ball Bearing Steel.** R. J. Hafsten. *Iron Age,* v. 156, July 5, '45, pp. 54-59.

For the purpose of softening SAE 52100 steel for machining and for preparing the carbides for subsequent hardening, the steel is given a spheroidizing anneal. With the aid of numerous photomicrographs, shows the factors influencing carbide spheroid formation, including the ideal austenizing temperature for

this purpose and control of spheroid size. Analysis of a properly hardened structure for ball and roller bearing service.

18-162. **Jet Quench Minimizes Aluminum Distortion.** *Iron Age,* v. 156, July 5, '45, p. 78.

High speed aluminum heat treating equipment consists of a General Electric furnace with throttling reactor controls, loading station and a quench chamber especially designed.

18-163. **Mechanical and Metallurgical Advantages of Martempering Steel.** B. F. Shepherd. *Product Engineering,* v. 16, July '45, pp. 438-441.

One of the most important recent developments in the field of the heat treating of steels, martempering, is explained in a series of graphs and tables which lead from fundamental considerations to the actual performance and the mechanical and metallurgical advantages of the new process.

18-164. **What Heat Treatment Does to Aluminum Alloys.** M. E. Tatman. *American Machinist,* v. 89, July 5, '45, pp. 118-121.

Producers of civilian equipment are keenly studying the merits of fabricated aluminum for use in light weight but strong postwar products; in this way they will be aided by the knowledge of aircraft manufacturing plants.

18-165. **Isothermal Heat Treatment.** *Automobile Engineer,* v. 35, June '45, pp. 249-251.

Use of controlled quenching cycles to give improved properties.

18-166. **Progressive Heating, Quenching.** A. R. Hotchkiss. *Steel,* v. 117, July 9, '45, pp. 104, 162.

Eliminates brittleness and warpage of small parts, increases output greatly. Setup employs induction heating unit.

18-167. **Fog Quench Reduces Dural Warping.** *Production Engineering and Management,* v. 16, July '45, pp. 93-94.

New method provides uniform quenching temperature, speeds transfer of parts from furnace to quench. Heart of this Bell-developed system is a self-cleaning atomizer nozzle.

18-168. **Bearing Races Improved by Isothermal Treatment.** J. Paul Deringer. *Metal Progress,* v. 48, July '45, pp. 80-87.

Outstanding results obtained in both quality and quantity of work, associated with generous economic advantages as outlined in an accompanying cost analysis. The performance reflects yet another accomplishment of the isothermal heat treatment.

18-169. **Comparative Results Obtained Through the Purnell Method of Heat Treating.** Charles G. Purnell and Henry Pfahl. *Steel Processing,* v. 31, June '45, pp. 364-370.

Purnell heat treating system represents a step further toward perfection in which control of the quenching phase of the heat treating operation is exercised to a much higher degree than formerly with an attendant improvement in uniformity of product. Illustrates several parts which have been heat treated according to the Purnell method, obtaining maximum hardness and toughness.

18-170. **Scaling Properties of Steels in Furnace Atmospheres, II.** A. Preece and R. V. Riley. *Steel Processing,* v. 31, June '45, pp. 379-382.

Results obtained in an examination of the scaling properties of steels at 1150° C. summarized. 3 ref.

18-171. **Fundamental Principles and Applications of Induction Heating. Part VII.** *Sheet Metal Industries,* v. 21, June '45, pp. 1037-1046, 1052.

Miscellaneous applications. 3 ref.

18-172. **Hardening High-Speed Steel.** Stewart M. DePoy. *Steel,* v. 117, July 16, '45, pp. 122, 163.

Effect of prior treatment on results of sub-zero process.

18-173. **Superheating in Magnesium-Base Alloys.** F. A. Fox and E. Lardner. *Engineering,* v. 159, June 15, '45, pp. 478-480.

Grain size of cast metal depends mainly upon the following factors: Mold conditions; casting temperature and speed of pouring; mechanical conditions, turbulence due to pouring or to gas evolution or vibration of mold; surface tension of the solid and liquid phases present during solidification; viscosity of the molten metal; other factors depend upon the nature of the alloys, such as energy of crystallization, latent heat of fusion, and solidification range; the presence of nuclei. (Institute of Metals.)

18-174. **Induction Case Hardening.** Vernon W. Sherman. *Iron & Steel,* v. 18, June '45, pp. 213-216.

Application of megacycle heating. (Electrochemical Society.) 3 ref.

18-175. **Tocco Hardening.** H. B. Osborn, Jr. *SAE Journal,* v. 53, July '45, pp. 377-386, 391.

Principles of induction heating with a discussion of the equipment needed, control factors involved, and applications in the automotive industry.

18-176. **Influence of Overaging on Aluminum Alloys.** *Iron Age,* v. 156, July 19, '45, pp. 66-67, 140, 142.

Effect of aging aluminum alloys for 24 hr. at various temperatures; mechanical properties of high strength aluminum alloy sheet subjected to overaging at 375° F.

18-177. **Unique Heating Equipment Speeds Heat Treating.** Gunnar Skog. *Tool Engineer,* v. 14, June '45, pp. 37-38.

A General Electric roller-hearth electric furnace, with loading and control stations, and a quench chamber. Latter includes an unique, automatic water

spray quench which minimizes the distortion that often results from quenching. Also includes a push button controlled load truck which eliminates the human factor in addition to providing a centralized operating position.

18-178. **The Influence of the Heat Treatment of Steel on the Damping Capacity at Low Stresses.** L. Frommer and A. Murray. Iron and Steel Institute Paper, Dec., '44, *Engineers' Digest* (American Edition), v. 2, June '45, pp. 303-305.

Experimental method adopted consists in supporting the material in such a manner as to facilitate its executing vibrations of a "free-free" character. The bar is forced into oscillation at one of its natural frequencies by an electromagnetic method, and the existence of such oscillation detected similarly. Determinations are made by noting the time required for the vibration amplitude to fall to half of an arbitrary initial amplitude subsequent to cutting off the driving power.

18-179. **Flame Hardening on Railroads.** Arthur Havens. *Welding Engineer*, v. 30, July '45, pp. 35-39.

Oxygen and acetylene are supplying an important new service to railroad maintenance. All types of locomotive and many passenger and freight car parts are being flame hardened for increased wear resistance.

18-180. **Agitation for Effective Quenching.** R. B. Seger. *Steel*, v. 117, July 23, '45, pp. 110, 154.

Produces uniform results in heat treating.

18-181. **Flame Hardening of Sprockets.** S. S. *Machinery* (London), v. 66, June 21, '45, pp. 669-674.

Describes in some detail the methods applied in the flame hardening of sprockets; manual method of spot hardening using one burner; manual method of spot hardening using two burners; fully automatic mechanical method with stationary burners; electric timers and air controls; progressive hardening method.

18-182. **An Appraisal of Subzero Hardening of High Speed Steel.** J. G. Morrison. *Iron Age*, v. 156, July 26, '45, pp. 54-59.

Summarizes accepted theory and facts regarding the process and points out secondary factors which may have been overlooked; theory of hardening steel and the role that carbon plays are reviewed in order to clarify some independent research reported in the second article to follow.

18-183. **Heat Treatment of Magnesium Alloy Castings.** *Light Metals*, v. 8, July '45, pp. 318-341.

Technique and plant requirements for the heat treating of ultra-light alloy castings; use of inert atmospheres.

18-184. **Heat Treating Magnesium Alloys.** *Steel*, v. 117, Aug. 6, '45, p. 124.

Elevator-type furnace holds temperatures within narrow range and produces parts with maximum physicals obtainable.

18-185. **Avoiding Decarburization in Heat Treating High Speed Steel Tools.** *Steel,* v. 117, Aug. 6, '45, p. 126.

High speed steel tools of all types—tungsten, molybdenum or cobalt—are being heat treated in production electric furnaces. No surface change occurs except a slight discoloration which becomes apparent when the tool is transferred from furnace to quench bath. Cutters of all types are made uniformly hard to the sharpest point.

18-186. **Atmospheres for Annealing Metals.** C. E. Peck. *Metals & Alloys,* v. 22, July '45, pp. 85-91.

Several types of controlled atmospheres used in the annealing and normalizing of ferrous and non-ferrous metals to keep them clean or bright and to prevent their decarburization (if ferrous) are classified and their specific applications discussed.

18-187. **Sub-Critical Annealing.** E. E. Howe. *Iron Age,* v. 156, Aug. 9, '45, pp. 52-55.

Procedure has been used on wide variety of steel compositions with resultant increased ductility, improved formability, and lower cost. Summarizes advantages.

18-188. **An Appraisal of Subzero Hardening of High Speed Steel.** J. G. Morrison. *Iron Age,* v. 156, Aug. 2, '45, pp. 64-70.

Points out the difficulty of properly hardening high speed steel tools and illustrates a condition where subzero cooling might prove distinctly beneficial. Effects of cold treatment are brought out strikingly on experimental high speed steels in which the carbon content is kept deliberately high in order to insure an excessive amount of retained austenite upon hardening. Increase in hardness as well as in size testifies to the marked effect that treating such specimens at —120° F. has on the transformation of austenite. 9 ref.

18-189. **Selection of Steel for Induction Hardening.** Elbert A. Hoffman and John M. Birdsong. *Tool Engineer,* v. 15, Aug. '45, pp. 27-29.

Metallurgical factors affect applications and permit wider choice of steel.

18-190. **Furnaces and Heat Treatment for Permanent Mold Magnesium Castings.** A. V. Keller. *Modern Metals,* v. 1, Aug. '45, pp. 20-21, 23.

Building and operation of a heat treating furnace and gives some of the causes contributing to substandard castings.

18-191. **The Plus and Minus of Induction Heating.** *Industrial Gas,* v. 24, July '45, pp. 16, 17, 29.

Discusses high frequency induction heating and three types of modern high frequency equipment.

18-192. **Application of Controlled Atmospheres to the Processing of Metals.** C. E. Peck. American Society of Mechanical Engineers *Transactions,* v. 67, Aug. '45, pp. 501-512.

Separately controlled atmospheres for use in conjunction with heat treating processes. By means of

controlled atmospheres, finish machined parts which require heat treatment can be processed without loss of surface hardness during heating, and without further grinding or cleaning. Outlines the principal types of atmospheres and describes briefly the equipment available for producing these atmospheres.

18-193. **Production Heat Treatment of Gears.** *Steel Processing,* v. 31, July '45, pp. 449-454.

Important factors which govern the classification and ultimate selection of materials for gears. Case hardening steels; carbon content of carburizing steels; the grain size of case hardening steels; alloy case hardening steels; effect of alloy additions; full hardening steels; recommended gear materials; distortion; preliminary normalizing and annealing; uniformity of heating; design and heat treatment.

18-194. **Induction Heating in Aluminum Fabrication.** Gilbert C. Close. *Light Metal Age,* v. 3, July '45, pp. 8-10, 50.

Aspects of induction heating, its present applications in the field of aluminum fabrication; and indicates some of the electromagnetic principles with which the aluminum metallurgist should acquaint himself.

18-195. **The Purnell Process for Heat Treating Steel.** C. G. Purnell and H. M. Pfahl. *Industrial Heating,* v. 12, July '45, pp. 1116, 1118, 1120, 1122, 1124, 1126, 1128, 1130.

Represents a step toward perfection in which control of the quenching phase of the heat treating operation is exercised to a much higher degree, with an attendant improvement in uniformity of product.

18-196. **Electric Salt Bath Furnace With Four Pots Provides Flexible Operation.** F. J. Skerritt. *Industrial Heating,* v. 12, July '45, pp. 1170, 1172.

A four-pot electrically heated salt bath furnace, with each pot heated by its own set of immersed electrodes.

18-197. **Wide Range of Furnace Types Broadens Scope of Lindberg Steel Treating Work.** *Industrial Heating,* v. 12, July '45, pp. 1216-1218, 1220, 1222, 1224, 1226-1227.

Describes furnaces and other equipment installed in the Lindberg plant for the performance of various commercial heat treatments.

18-198. **Sub-Zero Tool Treatment—Some Practical Aspects.** F. T. Dean. *Western Machinery & Steel World,* v. 36, July '45, pp. 298-301, 328.

Basic facts in evaluating the possible benefits from cold treating.

18-199. **Tank Quenching of Heat Treated Aluminum.** *Western Machinery & Steel World,* v. 36, July '45, pp. 322-323, 327.

El Segundo Plant of the Douglas Aircraft Co. has developed a tank quenching mechanism for box type air ovens which meets the requirements and which eliminates most of the drawbacks of other means of

heat treating and quenching formed aluminum alloy parts.

18-200. **Heat Treatment.** *Automobile Engineer,* v. 35, July '45, pp. 281-282.
Current practice in the reduction of distortion; non-simultaneous phase changes; temperature gradient; gradients during the heating cycle; salt baths; atmosphere furnaces; hot quenching; important factors for the avoidance of distortion; effect of surface finish; carburizing; equipment.

18-201. **Cyanide Nitriding Increases Hardness of High Speed Cutting Tools.** John E. Lynch and Carl W. Snyder. *American Machinist,* v. 89, Aug. 16, '45, pp. 124-126.
Five-point method of chemical treatment which augments the regular hardening processes.

18-202. **High Speed Gas Heating Technique.** Frederic O. Hess. *Western Metals,* v. 3, Aug. '45, pp. 29-30, 33.
Heating steel billet; temperature differential.

18-203. **The Annealing of Whiteheart Malleable Iron by a Gaseous Process.** A. G. Robiette. *Foundry Trade Journal,* v. 76, July 26, '45, pp. 255-260.
Development of a practical and economical process on an industrial scale. 5 ref.

18-204. **Ammonia for Processing Metals.** E. R. Woodward and R. J. Quinn. *Metals & Alloys,* v. 22, Aug. '45, pp. 418-424.
How ammonia and its derivatives can be applied to solve problems in case hardening, heat treating, brazing, sintering and welding metals. 11 ref.

18-205. **Modern Heat Treating Practice.** Arnold P. Seasholtz. *Steel,* v. 117, Sept. 3, '45, pp. 120-122, 176, 178, 180, 182.
Theory of heating and quenching as a means for obtaining ultimate desired physicals in the majority of carbon and alloy steels. Covered in detail are hardenability vs. hardness, effect of various rates of heating and cooling, construction and interpretation of S-curves.

18-206. **The Annealing of Whiteheart Malleable Iron by a Gaseous Process.** A. G. Robiette. *Foundry Trade Journal,* v. 76, Aug. 2, '45, pp. 275-285.
Annealing cycle; test requirements; after-treatment of whiteheart malleable iron; effects of alloys and composition. 4 ref.

18-207. **Aluminum Alloy Sheets and Sections Heat Treated in Specially Designed Furnaces.** *Industrial Heating,* v. 12, Aug. '45, pp. 1322, 1324, 1326, 1328, 1330.
Quenching mechanism; element design.

18-208. **Surface Hardening of Metals.** *Industrial Heating,* v. 12, Aug. '45, pp. 1332, 1334, 1336, 1338.
Selection of frequency and time cycles for induction heating; induction hardening of plain carbon steels; shot for metal peening.

18-209. **Case Hardening Anomalies.** C. A. E. Wilkins. *Metal Treatment,* v. 12, summer '45, pp. 95-103.
In view of the need for correct manipulation of case

hardening steels to limit frictional wear, suggests coordinated minimum hardness, ultimate strength, elongation, and impact figures for all the common carburizing steels. Discusses various aspects of manipulation such as the causes of soft spots, the effects of low temperature tempering, and of working above the normal temperature range. Carburizing heat treatment and grinding operations are cited as main sources of grinding cracks.

18-210. **Applying Prepared Atmospheres to Metal Processing.** E. G. De Coriolis. *Steel Processing,* v. 31, Aug. '45, pp. 509-513.

Preparation of atmospheres; types of equipment; atmosphere-furnace construction; operation of bell annealer. 6 ref. (From American Society of Mechanical Engineers.)

18-211. **The Annealing of Whiteheart Malleable Iron by a Gaseous Process.** A. G. Robiette. *Foundry Trade Journal,* v. 76, Aug. 9, '45, pp. 305-310.

Plant and operating conditions; economies of the gaseous process.

18-212. **Modern Heat Treating Practice.** Arnold P. Seasholtz. *Steel,* v. 117, Sept. 10, '45, pp. 114-116, 172, 174, 176, 178, 180, 182, 184, 186, 189.

Testing for hardenability and other characteristics in steels has developed successfully into four principal techniques. McQuaid-Ehn and Jominy tests; method and choice of quenching media.

18-213. **Putting Metal on Its Mettle.** Fred W. Whitcomb. *Refrigeration Industry,* v. 2, Sept. '45, pp. 25, 43.

Sub-zero refrigeration processing for cold treatment of metals is an important wartime development with almost unlimited future possibilities.

18-214. **Liquid Carburizing of Transmission Gears at the Cleveland Tractor Works.** W. A. Silliman. *Industrial Heating,* v. 12, Sept. '45, pp. 1504, 1506, 1508, 1510, 1516.

Performance of the carburizing treatment in electrically heated salt baths has practically eliminated troubles caused by distortion and reduced scrap due to this cause to practically nothing. Salt bath furnaces; operating procedure; carbon steel fixtures; submerged oil spray quench; control equipment and auxiliaries; sand blasting before grinding; production figures; flexibility of installation.

18-215. **Heat Treating Tank Parts in Buick Plant.** *Industrial Heating,* v. 12, Aug. '45, pp. 1292-1296, 1298, 1300, 1302, 1304, 1306, 1308, 1310, 1312, 1314, 1316.

Batch-type carburizing furnaces; continuous gas-carburizing furnaces; controlled atmosphere continuous hardening furnace; continuous double-muffle hardening furnace; electrically heated hardening and draw furnaces; compound-carburizing furnaces; convection-type continuous draw furnaces; miscellaneous equipment.

18-216. **Special Processes Feature Operations of Alfred Heller Heat Treating Company.** *Industrial Heating,* v. 12, Aug. '45, pp. 1396, 1398, 1400, 1402, 1404, 1406, 1424-1425.

Box-type heat treating furnaces; salt bath hardening

furnaces; nitrate salt bath tempering furnaces; furnaces for high speed steel; convection heated furnaces; oil bath; high frequency electrical induction units; sub-zero apparatus; plating equipment, miscellaneous facilities.

18-217. **Recent Developments in Engineering Materials.** Archibald Black. *Machinery* (London), v. 67, Aug. 2, '45, pp. 127-130.

Isothermal transformation of steel; interrupted quenches; cold treatment of steel; leaded steels; nitride case-hardening of stainless steels; silicon impregnation of steel; porous-chromium surfacing; die-casting materials and practice; tinless solders.

18-218. **High Frequency Dielectric Heating.** A. E. L. Jervis. *Electronic Engineering,* v. 17, Aug. '45, pp. 624-628.

Equipment already available; principle.

18-219. **A Bibliography of H. F. Heating.** *Electronic Engineering,* v. 17, Aug. '45, pp. 629-630.

Title, author, reference.

18-220. **Calculations for Dielectric Heating by High Frequency Current.** A. J. Maddock. *Electronic Engineering,* v. 17, Aug. '45, pp. 635-640.

Design sheets have been prepared to enable all the necessary factors to be obtained readily by inspection and to show, at a glance, the interdependence of many of the factors.

18-221. **Modern Heat Treating Practice.** Arnold P. Seasholtz. *Steel,* v. 117, Sept. 17, '45, pp. 132, 134, 137, 164, 166, 168, 170.

Effectiveness of three systems of interrupted quenching in obtaining higher physicals with minimum dimensional changes, distortion, warpage and residual strains as well as scale-free surfaces. Cycle annealing is an additional topic of great interest.

18-222. **Effect of Preliminary Heat Treatment on Response to Nitriding of Some Steels.** *Industrial Heating,* v. 12, Sept. '45, pp. 1512, 1514, 1516.

Details of the experimental work described and illustrated, and possible explanations of the results obtained.

18-223. **Modern Heat Treating Practices.** *Industrial Heating,* v. 12, Sept. '45, pp. 1521-1522, 1524, 1526.

Short cycle annealing; propeller heat treatment; advanced quenching practice; controlled gas carburizing; protective atmospheres and gas quenching.

18-224. **Hardenability Vs. Percentage of Martensite in Low Alloy Steels.** J. M. Hodge and M. H. Orehoski. *Industrial Heating,* v. 12, Sept. '45, pp. 1530, 1532.

Relationship between hardenability and the percentage of martensite in some low alloy steels. Metallographic examination was used to study quenched Jominy test bars to provide the data on which this paper was based. (A.I.M.E. paper.)

18-225. **Heat Treating Precision Parts at the A. B. Equipment Manufacturing Company.** *Industrial Heating,* v. 12, Sept. '45, pp. 1580, 1582, 1584, 1586, 1588.

Tool hardening equipment; electric salt bath furnace;

high temperature, pit type convection furnace; pit type carburizing furnace; pit type draw furnace; electrically heated, pit type nitriding furnace; pot type furnaces; cleaning, testing and inspection.

18-226. **Heat Treatment Study of Pearlitic Malleable Cast Iron.** R. W. Lindsay and J. E. Atherton. *American Foundryman,* v. 8, Sept. '45, pp. 27-32.

Investigation of certain phases of the heat treatment of pearlitic malleable cast iron—an attempt to show a correlation between the microstructures and hardness values obtained. Heat treatments—oil quenching followed by tempering, and isothermal transformation at various subcritical temperatures. 11 ref.

18-227. **Carburizing and Nitriding.** A. H. Allen. *Steel,* v. 117, Sept. 24, '45, pp. 118-119, 166.

Carried out continuously in muffle-type furnace produce file-hard surface and dead-soft centers in thin-gage steel pieces, such as thrust washers and retainer rings.

18-228. **Modern Heat Treating Practice.** Arnold P. Seasholtz. *Steel,* v. 117, Sept. 24, '45, pp. 153-154, 157, 176, 178, 180.

Defines purpose of carburizing steel and relates explicitly how a hard surface can be produced upon a tough, ductile core.

18-229. **Whiteheart Malleable.** A. G. Robiette. *Iron & Steel,* v. 18, Sept. '45, pp. 421-424.

New gaseous process for annealing. Properties required; after-treatment of whiteheart malleable iron; effects of alloys and composition; austenitic malleable irons; plant and operating conditions; economies of the gaseous process.

18-230. **Alloy Steel Bars.** *Iron & Steel,* v. 18, Sept. '45, pp. 439-440.

Electric furnaces for hardening and tempering.

18-231. **Refrigerating Aluminum to Arrest Age Hardening.** M. L. Rask. *Modern Metals,* v. 1, Oct. '45, pp. 19-21.

Outline of arresting age hardening of heat treatable aluminum alloys deals with a refrigerated method. Purpose of refrigerating is to keep the aluminum in a soft and workable condition prior to forming. Advantage is in preventing high strength alloys like 75S from aging, if there is to be an interval between heat treating and final forming. 4 ref.

18-232. **Research Finds the Answer.** William M. Sutherland. *Modern Machine Shop,* v. 18, Oct. '45, pp. 184, 186, 188, 190, 192.

New heat treat chemicals discovered to replace critical materials.

18-233. **Continuous Heat Treatment of Bars by High Frequency Induction.** *Machinery* (London), v. 67, Sept. 13, '45, pp. 281-284.

Continuous heat treatment is applied to bars normally supplied in the hardened and tempered condition. Bar is fed continuously through an inductor coil, and is heated

by the high frequency eddy currents induced in it by the current in the coil. The rate of increase in temperature while the bar is magnetic is more rapid than after the Curie point is passed. Final temperature adjustment is effected by carefully controlling the speed of travel of the work and the power input.

18-234. **Molten Baths for the Wire Industry, Part I.** F. R. Morral. *Wire & Wire Products,* v. 20, Oct. '45, pp. 736-737, 740-741.

Review of the various uses of salt baths in the wire industry for cleaning, heat treating, and others. History of fused salts as applied to the wire industry is summarized from the patent and technical literature. Properties and new work. 57 ref.

18-235. **Annealing High Carbon Wire Stock.** J. H. Loux. *Wire & Wire Products,* v. 20, Oct. '45, pp. 742-745, 748-749.

Importance of correct atmosphere in the prevention of decarburization, with particular reference to moisture content. Recarburization is possible with close control, but its practicality is still a moot point.

18-236. **Solution Heat Treatment.** *Metal Industry,* v. 67, Sept. 21, '45, p. 184.

Indirectly heated electric furnace for aluminum alloys. (From *Industrial Heating.*)

18-237. **Induction Heating and Heat Treating.** Harry B. Osborn, Jr. *Metal Progress,* v. 48, Oct. '45, pp. 801-806.

Historical background; influence of magnetism on high frequency heating; dielectric heating; relations between frequency, diameter and penetration; non-cylindrical parts; internal hardening; power sources. Formulae for resistance heating; formulae for induction heating.

18-238. **Important Achievements of Induction Heating.** *Metal Progress,* v. 48, Oct. '45, pp. 806-814, 832.

Frequencies up to 10,000 cycles, by Harry B. Osborn, Jr.; Frequencies from 100,000 to 500,000, by Jules J. Fox; Vacuum tube units, by J. Wesley Cable.

18-239. **In Wartime—Salt Baths—In Peacetime.** W. W. Winters. *Metal Progress,* v. 48, Oct. '45, pp. 815-817.

Improvement in furnace design has been the utilization of suitable refractory pots for many heat treatments previously carried out in metallic alloy pots. Ceramic containers have directly lengthened pot life in high speed steel tool hardening installations.

18-240. **Heat Treating Diagrams — S or TTT-Curves.** F. R. Morral. *Metal Progress,* v. 48, Oct. '45, pp. 818-832.

Use of S or TTT-curves for steel gives a fairly accurate prediction for designing a heat treatment to meet any normal requirements. Treatments which can be established if a curve of the steel or of a similar analysis is available are spheroidizing, normalizing, annealing, hardening, martempering and austempering. Isothermal transformation curves for some 190 analyses are available and indexed. Typical curves and tables of thermal data are shown by means of which the metallurgist or heat treater,

to whom the references were not available, could draw his own diagram with reasonable accuracy.

18-241. **Maximum Carbon in Carburized Cases.** Sidney Breitbart. *Iron Age,* v. 156, Oct. 11, '45, pp. 50-52.

Practical aspects of the author's nucleation theory that the excessive or normal carbon content of a carburized surface depends on the presence of free carbides in the steel during carburization. Effects of carburizing medium, carburizing potential, temperature and steel chemistry described and a method of control of the carburizing process in order to eliminate carburized cases containing excessive carbon contents.

18-242. **Spheroidizing Treatment.** Eric N. Simons. *Machinery* (London), v. 67, Aug. 23, '45, pp. 210-213.

Three conditions of steel; nature of spheroidizing; breaking down the pearlite; effect of fine grain; spheroidizing ball bearing steel; spheroidizing steel for cold pressings.

18-243. **Effect of Various Surface and Structural Conditions on Nitriding.** F. F. Dodson. *Metallurgia,* v. 32, Aug. '45, pp. 149-151.

With the object of reducing the time factor, generally associated with the nitriding process, experiments have been carried out in an effort to relax preliminary precautions usually considered to be necessary to produce the desired case and obtain the physical properties sought in the core. Effects of various surface and structural conditions on the results obtained after nitriding DTD.87A and DTD.306 material, including different methods of operating the process.

18-244. **The Water Quenching of Steel Castings.** *Metallurgia,* v. 32, Aug. '45, pp. 175-177.

Developments in the water quenching of steel castings; problems in the quenching of miscellaneous sized castings; design and mass in water quenching; the water quenching of small and of large castings; and facilities for water quenching steel castings.

18-245. **Uncommon Applications of High Frequency Heating.** E. D. Tillson. *Iron Age,* v. 156, Oct. 4, '45, pp. 72-73, 158, 160.

Believing that induction heating was not sufficiently known or used outside the regular metal working industries, Commonwealth Edison Co. set up a testing laboratory. Interesting and unusual applications devised are described.

18-246. **New Heat Treat Neutralizing Chemical.** William M. Sutherland. *Iron Age,* v. 156, Oct. 4, '45, p. 82.

Sodium acid sulphate gives successful results and saves approximately 75% in cost of materials.

18-247. **Spheroidizing Treatment.** Eric N. Simons. *Machinery* (London), v. 67, Aug. 30, '45, pp. 235-237.

Transformation treatment; importance of temperature; types of furnaces; preheating low carbon steels; spheroidizing alloy steels; transformation time; decarburization; graphitization.

18-248. **Effective Use of Dissociated Ammonia.** C. V. Snell. *Metals & Alloys,* v. 22, Sept. '45, pp. 727-730.

Economies and advantages of, and equipment and practice for using ammonia effectively in metal processing. 8 ref.

18-249. **Gas Carburizing.** Ernest S. Kopecki. *Iron Age,* v. 156, Oct. 18, '45, pp. 50-53.

General summary of carburization and decarburization and discussion of the choice of steel for best results and the effect of grain size.

18-250. **Conveyorized Non-Decarburizing Heat Treatment of Gears.** W. J. Bornholdt and H. E. Scarbrough. *Iron Age,* v. 156, Oct. 18, '45, pp. 54-57.

By the continuous method of heat treatment described, data are furnished on how average costs have been cut in half against those of other methods. Cleaning and tin plating to overcome scaling have been eliminated.

18-251. **Chromium, Silicon and Aluminum Impregnation of Steel.** *Iron Age,* v. 156, Oct. 18, '45, pp. 58-61.

Methods and procedures for impregnating steel with chromium, silicon and aluminum. (From *Stal.*)

18-252. **Induction Heating of Small Parts.** Seward A. Covert. *Iron Age,* v. 156, Sept. 27, '45, pp. 60-63.

Because high frequency current has only shallow penetration, induction heating is particularly well suited for the heating of small parts. Various applications of high frequency hardening and annealing described.

18-253. **Modern Heat Treating Practice.** Arnold P. Seasholtz. *Steel,* v. 117, Oct. 1, '45, pp. 126, 129-130.

Recommended procedure for heat treating high speed steel.

18-254. **Controlled Heat Treating.** Leon N. Olberg. *Western Machinery & Steel World,* v. 36, Sept. '45, pp. 400-401.

Use of standard end-quench hardenability test.

18-255. **Direct Resistance Heating of Salt Baths for the Patenting of Steel Wire.** W. Heidenhain. *Stahl & Eisen,* v. 64, 1944, pp. 747-428. *Engineers' Digest* (American Edition), v. 2, Sept. '45, pp. 427-428.

Development of a method in which the molten salt contents of the pot act as the resistor. Heating process is initiated by creating a liquid bridge between the electrodes by means of a special electric heating ribbon extending between the electrodes. This ribbon is removed from the bath after the flow of current between the electrodes has been established. Diagrammatic view of the bath installation is given.

18-256. **Effect of Variations in Composition and Heat Treatment on Some Properties of 4 to 6% Chromium Steel Containing Molybdenum and Titanium.** George F. Comstock. American Society for Metals Preprint 4, 1945, 30 pp.

Hardness, tensile properties, notch impact resistance, microstructure, weldability, high temperature oxidation, and time for rupture under stress at high temperature, reported for 31 different 5% chromium-molybdenum-titanium steels. 18 ref.

18-257. **Mass Temperature Effects on Quenching 36% Cobalt Magnet Steel.** Benjamin Falk. American Society for Metals Preprint 6, 1945, 21 pp.

Effect of mass on the magnetic properties of a 36% cobalt magnet steel. Purpose was to obtain by heat treatment maximum magnetic values for all commercial sizes of this steel. An empirical relationship between mass and quenching temperature. Mathematical development of this formula is presented, which demonstrates that the empirical relationship is well founded on the concepts of the mass effect evolved by previous investigators, and possesses some measure of physical significance. 19 ref.

18-258. **Induction Hardening and Austenitizing Characteristics of Several Medium Carbon Steels.** D. L. Martin and W. G. Van Note. American Society for Metals Preprint 17, 1945, 36 pp.

Hardenability and austenitizing characteristics of the following medium carbon steels were studied: SAE 1050, 1350, 2350, 4160, and NE 9255, and the results discussed in their relation to the induction hardening characteristics. Effect of alloying elements and microstructure on the induction hardening characteristics is described. The steels with low Ac_1-Ac_3 temperatures, little or no free ferrite, and medium to deep hardenability are ideal for surface induction hardening. Of the five steels investigated, the SAE 1350 and 2350 come closest to these specifications. Attention has been given to the effect of retained austenite and internal stresses on hardness. 31 ref.

18-259. **Quenching of Steel Balls and Rings.** Victor Paschkis. American Society for Metals Preprint 20, 1945, 30 pp.

Temperature-time-space relationships obtained in quenching steel spheres and cylindrical rings were investigated on the "Heat and Mass Flow Analyzer" at Columbia University. For spheres, general curves are presented, in which the delaying effect of heat of transformation in the range from 480 to 300° F. has been included. In addition a large number of investigations have been carried out in which the change of thermal properties (conductivity and specific heat) with temperature has been considered. For steel rings charts have been developed which show the complete temperature-time-space relationships in rings of any size and material of constant thermal properties. 15 ref.

18-260. **Cold Working and Heat Treatment of a 10-Karat Gold Alloy.** Vernon H. Patterson and B. Nicholas Iannone. American Society for Metals Preprint 21, 1945, 21 pp.

Cold working prior to aging changes the mechanical properties and the corrosion resistance toward certain media. Aging at 600° F. produced the optimum mechanical properties on material cold reduced over 25%, after a solution heat treatment at 1250° F. for an hour, prior to cold working. Aging at 700° F. produced the best results on reductions in thickness less than 25%. Resistance of the alloy to attack by concentrated nitric acid increased at aging temperatures of 700° F. or higher, and appeared to be independent of the degree of cold working prior to aging. Resistance to attack by artificial perspiration de-

pended on both the degree of cold working and the aging temperature. 3 ref.

18-261. **Metallurgical Characteristics of Induction Hardened Steel.** James W. Poynter. American Society for Metals Preprint 22, 1945, 34 pp.

Specimens of SAE 4340 steel, heat treated by induced high frequency (355,000-cycle) electric currents and quenched, have same metallurgical characteristics as furnace-heated and quenched specimens. Depth of hardening is increased by increasing heating times (lower power input) to produce the same surface temperature or by heating to higher surface temperatures with the same power input. Samples containing small carbide particles respond more readily to heat treatment than those in which the carbide particles are larger. No evidence is found to indicate that induction heating results in more rapid solution and transformation rates and in the absence of grain coarsening at higher temperatures. It is believed that the effect of frequency on depth of hardening has been overemphasized since the rate of heat flow also has a definite effect on depth of hardening. 12 ref.

18-262. **A Mechanism of the Surface Decarburization of Steel.** W. A. Pennington. American Society for Metals Preprint 30, 1945, 44 pp.

Study has been made of the decarburization of an ordinary carbon steel of eutectoid composition at temperatures from 1275 to 1700° F. at intervals of temperature which were in general 50° F. A mixture of hydrogen and water vapor containing approximately 20% (by volume) of water vapor was used as a medium to effect the decarburization. Water vapor has been regarded as a reactant and not as a catalyst. Photomicrographs show the progress of decarburization with time at the different temperatures and also the general nature of the phenomenon at the different temperature levels. 22 ref.

18-263. **Heat Treating B-29 Super-Fortress Engine Parts in Mammoth Dodge-Chicago Plant.** *Industrial Heating,* v. 12, Oct. '45, pp. 1658-1660, 1662, 1664, 1666, 1668, 1670, 1672, 1674, 1676, 1678, 1680, 1682, 1684, 1686, 1688, 1690.

Operations include hardening, annealing, tempering, carburizing and nitriding on such parts as center cranks, front and rear cams, accessory-drive gears, stationary reduction-gear supports, oil-pump drive gears, accessory drives and starter shafts, and so on, for a total of 87 different parts.

18-264. **Fabricating and Heat Treating Hollow Steel Propeller Blades at Curtiss-Wright Plant.** *Industrial Heating,* v. 12, Oct. '45, pp. 1702-1704, 1706, 1708, 1710, 1712, 1714, 1716.

Improvements in methods for milling, welding, forming, heat treating and inspection.

18-265. **Rapid Heating to Forging or Heat Treating Temperatures With Gas.** *Industrial Heating,* v. 12, Oct. '45, p. 1778.

By completely combusting large amounts of gas in small burner volumes, and grouping many such burners in "patterned" banks closely surrounding the work, remarkable rates of heat transfer into steel have been achieved.

18-266. Precision Treatment of Tools and Dies Is Specialty of Akron Steel Treating Co. *Industrial Heating,* v. 12, Oct. '45, pp. 1790-1792, 1794.

Operations include high speed and carbon steel hardening, tempering, annealing, normalizing and other routine treatments. Views of the interior of the plant are shown.

18-267. How Heat Treatment Affects High Strength Irons. C. R. Austin. *American Machinist,* v. 89, Oct. 25, '45, pp. 118-120.

Annealing for stress relief; annealing for improved machinability; quenching for hardness; interrupted quenching; martempering.

18-268. Effect of Assembly Aging on the Properties of Several Aluminum and Magnesium Alloys. G. R. Bailey and Max E. Tatman. *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 24-25, 29.

Attempts to answer some of the questions concerning effects on the physical properties and corrosion resisting characteristics of various materials and alloys that might comprise a reproduction assembly, if artificially age hardened with the clad 24S aluminum alloys at 375° F. for 6½ hr., or with the new 75S at 250° F. for 24 hr.

18-269. Corrosion Resistance of Heat Treated 24S Aluminum Alloy. Charles Nagler. *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 26-29.

Investigation reveals that the hardness, tensile strength, and elongation when produced in heat treatment is independent of the speed of quench from the solution treatment temperatures. The salt water corrosion resistance as measured by the immersion test is dependent on the speed of quench from the solution temperature.

18-270. Gas Carburizing. Ernest S. Kopecki. *Iron Age,* v. 156, Nov. 1, '45, pp. 60-63.

Bright carburizing, the restoration of carbon to a decarburized surface and the heat treatment of carburized parts are discussed. How to select correct gas carburizing equipment is also considered.

18-271. Improved Machinability Claimed in Steel Bars That Are Continuous Hardened by Induction. *Screw Machine Engineering,* v. 6, Oct. '45, pp. 47-49.

Bars inductively hardened reveal improved machinability while heat treatment costs are, in most cases, lower by 50% than those for conventional methods long considered standard. An actual saving of $15 per ton is possible.

18-272. Don't Make Your Conversion Answers Too Hard. Lawrence R. Foote. *Industrial Gas,* v. 24, Oct. '45, pp. 13-14, 32, 34.

Lead pot furnace, with adaptations, was selected after a thorough study by a Midwest manufacturer for heat treating high quality small hand tools. Revised method of heat treating showed an average increase in production of better than 300% over the former method. Also it provided a heat treating method which was low in initial investment, low in maintenance cost, flexible and foolproof in operation.

18-273. **Eclipse Counterbore Has Efficient Heat Treat Department.** Gerald Eldridge Stedman. *Industrial Gas,* v. 24, Oct. '45, pp. 15-17, 35-36.

Industrial gas is used in the Eclipse heat treat department, supplying heat to ten furnaces which perform the following functions: Cyaniding, liquid carburizing, carburizing, drawing and annealing. The gas used is 100% natural, with an approximate 1030 B.t.u. content and is piped to the plant by a 6-in. main. The general technique in the carburizing furnaces is standard. They perform the function of heat treat for the relief of strains and stresses. These furnaces attain temperatures of 1650° F. and are fired by six jets, set in opposite stagger.

18-274. **High Speed Metal Heating With Burners Radiant Ceramic.** Harry W. Smith. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1074-1078.

Ceramic-supported combustion, as pioneered in the Selas ceramic burner, and its revolutionary achievement in speeding the heat treatment and heating of metal parts.

18-275. **The Heat Treatment of Steel Castings.** *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1127, 1129.

Annealing; normalizing; quenching; compound heat treatments. Includes effects of heat treatment of steel castings.

18-276. **Gas Carburizing.** Ernest S. Kopecki. *Iron Age,* v. 156, Oct. 25, '45, pp. 52-58.

Reactions of the various atmospheres used in carburizing process are described. Control of soot precipitation and the physical and chemical factors involved in gas carburization are discussed.

18-277. **New Heat Treat Chemicals Replace Critical Materials.** William M. Sutherland. *Western Metals,* v. 3, Oct. '45, pp. 24-25.

Every pound of sodium acid sulphate used in place of sodium dichromate releases approximately the equivalent of one pound of chromium metal for other purposes. A monetary saving is also effected.

18-278. **Production of Whiteheart Malleable Iron by Annealing in Partially Burnt Town's Gas.** I. Jenkins and S. V. Williams. *Foundry Trade Journal,* v. 77, Oct. 4, '45, pp. 91-99.

Annealing time is reduced and difficulties of handling the ore are obviated.

18-279. **Sealing Bronze Pressure Castings Through Heat Treatment.** Fred L. Riddell. *American Foundryman,* v. 8, Oct. '45, pp. 24-29.

Pressure tightness of leaky bushings of gun metal, valve bronze and hydraulic bronze was improved when they were annealed for 3 hr. at 1200 to 1300° F. in an air or oxygen-rich air atmosphere. No sealing whatever took place in a hydrogen atmosphere. When bushings previously improved in pressure tightness by annealing in the oxygen-rich air were re-annealed in hydrogen, the pressure tightness decreased by 25 to 50%. Removing the outer layer of oxide scale after sealing in air did not cause

appreciable loss in pressure tightness provided that the bushings were annealed for 3 hr. at the necessary temperature. 7 ref.

18-280. **New Electrode Salt Bath.** *Wire Industry,* v. 12, Oct. '45, p. 533.

Small simplified unit. Compact and of sturdy construction, occupying little floor space, yet capable of being extended as necessary to form a battery of units for treatments which have to be carried out in sequence.

18-281. **Precision Quenching.** Edwin Laird. *Scientific American,* v. 173, Nov. '45, pp. 274-276.

By control of the pressure, temperature, and turbulence of quenching medium, engineers have made it possible to predict, with high accuracy, the exact amount that metals will be distorted by heat treatment. Through use of these methods, machining time can be reduced.

18-282. **Hard Steel Surfaces.** Donald Taylor. *Automobile Engineer,* v. 35, Oct. '45, pp. 401-404.

Some notes on current materials and methods of preparation. Chemical changes; carburizing; gas carburizing; selective carburization; excess stock; sand packing; cement treatment; possible troubles; nitriding; physical changes; deposition; welding and spraying.

18-283. **How Heat Treatment Affects High Strength Irons, II.** C. R. Austin. *American Machinist,* v. 89, Nov. 8, '45, pp. 110-111.

Studies of spheroidization show how the physical properties of irons in the as-cast condition can be changed by annealing.

18-284. **Graphite in Cold-Rolled Subcritically Annealed Hypo-Eutectoid Steels.** M. A. Hughes and J. G. Cutton. American Society for Metals Preprint 13, 1945, 20 pp.

Study was made to determine the effect of (a) temperature, (b) residual alloy, (c) variations in per cent cold reduction, (d) mode of deoxidation, (e) full annealing prior to cold reduction, and (f) carbon content, on the susceptibility to graphitization. Fine grain strip having 0.08 to 0.67% carbon was graphitized when cold-rolled and subcritically annealed. Hot-rolled strip of silico-manganese steel was also graphitized by cold rolling and subcritical annealing. Data presented to show the solution rate of graphite, in cold-rolled annealed strip, at the normal heat treating temperatures. 9 ref.

18-285. **Wax Masking for Selective Copper Plating.** C. E. Ernst. *Metal Progress,* v. 48, Nov. '45, pp. 1099-1101.

A practical, speedy and inexpensive way of stopping off copper when parts are copper plated for selective carburizing. Procedure described.

18-286. **Age-Hardenable Beryllium-Copper.** W. F. Randall. *Engineers' Digest* (American Edition), v. 2, Oct. '45, pp. 511-514. *Wire Industry,* v. 12, April, '45, pp. 195-197.

Precautions to be used and properties which can be expected from heat treatment of copper alloy containing 2.0 to 2.5% beryllium and up to 0.5% cobalt or nickel.

18-287. **The Application of Ms Points to Case Depth Measurement.** E. S. Rowland and S. R. Lyle. American Society for Metals Preprint 24, 1945, 21 pp.

Method is based upon the change in martensite point temperature with variation in carbon content. Data on nine commercial carburizing steels. Comparisons made between the experimental Ms points derived from this investigation and those arrived at through calculations by means of the published formulae.

18-288. **Toughening Tank-Wheel Rims by High Frequency Induction.** *Machinery* (London), v. 67, Oct. 11, '45, pp. 393-396.

The whole system is so interlocked and automatically controlled that the machine may be operated by unskilled workers. By the mere pressure of a button, the controlled cycle of operations is put into motion, and a remarkably high output of uniform quality is obtained.

18-289. **Production of Whiteheart Malleable Iron by Annealing in Partially Burnt Town's Gas.** I. Jenkins and S. V. Williams. *Foundry Trade Journal,* v. 77, Oct. 11, '45, pp. 113-116.

Annealing time is reduced and difficulties of handling the ore are obviated.

18-290. **Modern Heat Treatment of Ferrous Materials.** J. R. Mott. *Canadian Metals and Metallurgical Industries,* v. 8, Nov. '45, pp. 26-28.

Hardness check; microscopic check; analyzing the consecutive cuts for carbon; change in weight; theoretically perfect gas; carburizing atmospheres.

18-291. **Induction Heating.** J. S. Edgar. *Canadian Metals and Metallurgical Industries,* v. 8, Nov. '45, pp. 28-30.

Applications and limitations as an industrial tool.

18-292. **Neutral Salt Bath Hardening.** Lawrence F. Train. *Canadian Metals and Metallurgical Industries,* v. 8, Nov. '45, pp. 31, 48.

Discusses preheat furnace, high-heat furnace, quench furnace, and draw furnace.

18-293. **The Heat Treatment of Steel.** Edwin Gregory and Eric N. Simons. *Edgar Allen News,* v. 24, Nov. '45, pp. 521-522.

The heat treatment of some special-purpose tool and other steels. Case carburizing.

18-294. **Spark Gap Converter as High Frequency Power Source for Induction Heating.** Otto Weitmann. *Steel,* v. 117, Nov. 19, '45, pp. 114-115, 130, 132.

Various setups attain fine record for uniformity and output in annealing, soldering, brazing, progressive heating for hardening, and in melting ferrous and non-ferrous metals.

18-295. **Nitriding Engine Parts.** Willard Roth. *Steel,* v. 117, Nov. 19, '45, pp. 122-123, 184, 186-187.

Experience in the large-scale manufacture of aircraft engines has resulted in improvement in equipment and practice and consequently in much lower costs. Likely to influence methods of heat treating parts for automotive and aircraft engines for domestic use.

18-296. Heat Treating B-29 Super-Fortress Engine Parts in Mammoth Dodge-Chicago Plant, Part II. *Industrial Heating,* v. 12, Nov. '45, pp. 1872-1874, 1876, 1878, 1900.

Tool-processing section; plating facilities.

18-297. Fabricating and Heat Treating Curtiss Hollow Steel Aircraft Propeller Blades, Part II. *Industrial Heating,* v. 12, Nov. '45, pp. 1888, 1890, 1892, 1894, 1896, 1898, 1900.

Heat treating processes and equipment.

18-298. Eectronic "Blow Torch" May Revolutionize High Frequency Heating. *Industrial Heating,* v. 12, Nov. '45, pp. 1902, 1904.

Device shown projects electronic waves on material to be heated, wherever it may be, whereas previous devices required that the object be placed in an electrical field created between two stationary metal plates or electrodes. Advantages cited.

18-299. Theory of High Frequency Heating. *Industrial Heating,* v. 12, Nov. '45, pp. 1926, 1928.

Radio frequency generators and their applications to industrial heating and heat treating applications, both by induction and dielectric heating summarized.

18-300. A Discussion on the Gas Annealing of Whiteheart Malleable. *Foundry Trade Journal,* v. 77, Nov. 1, '45, pp. 181-188.

High temperature and decarbonization; possibility of gas stagnation; experiments with ammonia; gas annealing and peeling; tensile results sought; weaker gas mixtures advocated; theory reviewed; continuous treatment; water-gas reaction; maximum decarburization.

18-301. Forging, Heat Treating and Flame Hardening Locomotive Parts. W. H. Ohnesorge. *Railway Mechanical Engineer,* v. 119, Nov. '45, pp. 509-513.

Report embraces material specifications, method of manufacture and heat treatment of a large variety of locomotive parts.

18-302. Larger Induction Heating Coils Meet Small-Lot Requirements. G. V. Bate. *American Machinist,* v. 89, Dec. 6, '45, pp. 91-94.

Six work coils of basic design enable job shop to handle wide variety of brazing and heat treating work of improved quality, on sound cost basis.

18-303. Radio Frequency Heating. *Metallurgia,* v. 32, Oct. '45, pp. 255-256.

Various adaptations of radio frequency heating. Directs attention to its application to treatment of ferromagnetic materials.

18-304. Preventing Surface Decarburization in Large Shaved Transmission Gears. E. G. de Coriolis. *Iron Age,* v. 156, Nov. 29, '45, pp. 56-61.

Methods and equipment used. Procedure involves several innovations, notably in prevention of surface decarburization by the use of bell type furnaces and cooling below 1000° F. therein before removal and subsequent hardening.

18-305. **Practical Heat Treatment and Annealing of Alloy Steel Bars.** Quintin C. McMillan. *Metal Treatment,* v. 12, Autumn, '45, pp. 177-182.

Describes modern plant for heat treatment and annealing of alloy steel bars and deals with its efficient operation and organization. Also suggests an efficiency coefficient.

18-306. **Processing and Fabrication of Stainless Steel Sheet and Plate Products. Part II.** H. S. Schaufus and W. H. Braun. *Steel Processing,* v. 31, Nov. '45, pp. 691-695.

Heat treatment of chromium-nickel materials.

18-307. **Bright Annealing of Nickel and High Nickel Alloys.** E. M. Kline and R. K. Gensler. *Metal Progress,* v. 48, Dec. '45, pp. 1283-1286.

Describes development of various annealing facilities of Huntington Works of International Nickel Co.

18-308. **Manufacture of File Hard Precision Gears.** W. G. Guthrie. *Metal Progress,* v. 48, Dec. '45, pp. 1300-1305.

Heat treating department at Allison Engine. Normalizing the forging; copper plating; carburizing; annealing and hardening; die-quenching; nitrided parts; less than ½% scrap.

18-309. **Steels for Nitriding.** *Materials & Methods,* v. 22, Nov. '45, pp. 1461, 1463.

Commonly used nitriding steels; case depth at a nitriding temperature of 975° F.; physical properties of some nitriding steels.

18-310. **Heat Treating Beryllium-Copper for Peak Performance.** H. G. Williams. *Iron Age,* v. 156, Dec. 6, '45, pp. 58-64.

Selection of best heat treatment requires: (1) Full knowledge of way part is used, (2) heat treating response data on lot of material to be used, and (3) testing of finished parts to make certain they perform as described. While primarily concerned with springs, the technique described applies as well to any part made from strip or wire.

18-311. **Heat Treating, Forming and Welding 75S Alclad.** Mitchell Raskin. *Iron Age,* v. 156, Dec. 6, '45, pp. 66-71.

Discusses metallurgy, corrosion resistance, and strength of the material, and gives some valuable information on the heat treatment necessary to develop maximum physical properties.

18-312. **High Frequency Induction Heating.** *Machinery* (London), v. 67, Nov. 15, '45, pp. 546-548.

Induction heating will produce highest possible power concentrations on certain classes of work. Moreover it lends itself to nicety of control which far exceeds that of any other heating method. (Abstract of paper presented to American Society of Mechanical Engineers.)

18-313. **Preventing Tool Galling by Nitriding.** *Steel,* v. 117, Dec. 10, '45, pp. 142, 144.

Three treatments, covering wide range of steel grades and tool services.

18-314. **Induction and Dielectric Heating Data.** *Tool Engineer,* v. 15, Nov. '45, p. 37.

Capacity of a parallel plate capacitor; powder input into a dielectric; "T" network equations; effective series resistance of a capacitor; dielectric loss factor; wave length along electrodes; dielectric heating in an air space; capacity of parallel plate capacitor with parallel layers of different dielectrics; voltage gradient in any dielectric layer in parallel plate capacitor with parallel layers of different dielectrics.

18-315. **Cycle Annealing of Hypo-Eutectoid Steels.** G. R. Brophy. *Iron Age,* v. 156, Dec. 13, '45, pp. 69-71.

Heat treatment outlined which cuts down conditioning time Pre-normalizing is beneficial in obtaining desired spheroidized structure. Method for insuring proper austenitizing temperature also proposed.

SECTION XIX

WORKING

Rolling, Drawing, Forging, Forming

19-1. **The Manufacture of Large Marine Engine Forgings.** Robert Liston. West of Scotland Iron & Steel Institute *Journal,* v. 51, part 5, pp. 107-121.

Deals with the shaping or forging of the required component from the ingot under a hydraulic forging press.

19-2. **Hydraulically Pressed Light Alloy Pistons.** Cecil Kimber. *Metallurgia,* v. 31, Nov. '44, pp. 31-38.

Developments in the application and processing of light alloys for pistons. Increasing need for greater strength for a given weight, under arduous operating conditions, led to the use of forged light metal pistons instead of the cast type. Two methods of producing wrought pistons are considered—hammered and pressed forgings—and particular attention is directed to the latter method for which the blanks are prepared by extrusion. Reference is made to the plant and equipment used in works especially designed for the production of light alloy pistons by the pressed method.

19-3. **Heading Capacity of Rivet Wire.** *Light Metals,* v. 7, Dec. '44, pp. 607-610, 612-614.

Theory and practice of a new testing system designed to meet production requirements. (*Aluminum* [Germany], v. 24, May '42, p. 60.)

19-4. **Shearing Flat Rolled Steel.** F. E. Flynn and D. A. MacArthur. *Iron & Steel Engineer,* v. 21, Dec. '44, pp. 41-65.

Although shearing is a relatively old process, almost no practical data have been available on the subject. Test results presented through the cooperation of the steel plant and the equipment manufacturer.

19-5. **Semi-Finished Steel.** Ross E. Beynon. *Iron & Steel,* v. 17, Dec. '44, pp. 722-726.

Describes some of the mills used for making these products, the rolling practices generally used, and a brief discussion of roll design for this service.

19-6. **Steel Cartridges of 3-In. Caliber.** Fred M. Arnold. *Metal Progress,* v. 47, Jan. '45, pp. 67-74.

Resumé of cartridge requirements and how they have been met with plain carbon steel, cold drawn and differentially hardened.

19-7. **Properties and Characteristics of Magnesium Forgings.** J. Colin Smith. *Metal Prcgress,* v. 47, Jan. '45, pp. 97-102.

Specifications and mechanical properties; choice of alloy; cost; applications; forgings versus castings; design.

19-8. **Upset Forging with the Flash Welder.** H. J. Malee and Gilbert C. Close. *Steel Processing,* v. 30, Dec. '44, pp. 791-793, 805.

Resistance flash welding machine for the production of upset forgings from both tubing and bar stock. Process is not only economical and relatively fast but produces a product that requires a minimum of finish machining, and that retains grain flow and other metallurgical characteristics, pertinent to quality output.

19-9. **Metallurgical Control of Aircraft Forgings.** A. J. Pepin. *Steel Processing,* v. 30, Dec. '44, pp. 771-779.

Metallurgical control maintains quality on existing parts, and assures it in new designs which require the development of new forging techniques. Illustrates the metallurgical organization chart with the various operating departments. (Paper presented at National Aeronautics Meeting, Society of Automotive Engineers, October 5-7, 1944, Los Angeles).

19-10. **Aluminum Bronze Extrusions.** Frank J. Miller. *Metals & Alloys,* v. 20, Dec. '44, pp. 1598-1603.

Method and equipment for extruding aluminum bronze described for the first time in this article not only represent a significant engineering achievement but also make available to designers a new material, whose characteristics and present uses are outlined.

19-11. **Light on Metalworking Trends is Shed by ASME Papers.** Guy Hubbard. *Steel,* v. 116, Jan. 8, '45, pp. 82-83, 137.

One of the several conclusions to be drawn from study of annual meeting transcripts is that scientific analyses of experimental work done in shop are yielding data on which postwar designs can be based with minimum of guess work.

19-12. **Forging Tube Forms.** *Steel,* v. 116, Jan. 8, '45, pp. 92, 94, 96.

Power hammers are ingeniously revamped to forge nose and tail on tube sections for bombs, using manually operated wheel and screw devices to feed work to dies. Automatic mechanisms rotate tubing continuously.

19-13. **Universal Slabbing Mill Differs From Most Designs.** A. G. Ericson. *Steel,* v. 116, Jan. 8, '45, pp. 108, 110.

Vertical rolls are separate from drives and are equipped with detachable couplings to facilitate roll changes. Mill rolls are direct driven through universal spindles by individual motors and can be reversed in three seconds. Wet and dry scale disposal systems

are provided. Gas scarfing machine is operated from pulpit by push button control.

19-14. **Utilizing Rubber Dies in Hydraulic Presses.** *Machinery,* v. 51, Jan. '45, pp. 152-156.

Use of rubber in die cutting and forming operations on a type of hydraulic press developed by the British Ministry of Aircraft Production.

19-15. **The New Contour Developer Simplifies the Building of Master Contours.** Jack L. McGraw. *Modern Industrial Press,* v. 6, Dec. '44, pp. 13-14, 46.

The amazing contour developer, a welcome boon to the overwrought pattern and die making industries, is not inconceivable but it is unbelievable. Developed entirely by the Contour Co. of Pasadena, Calif., it proves unquestionably that templates are unnecessary prerequisites in the building of excellent master contours.

19-16. **Production Problem of Weiss Joints Solved by Chevrolet.** P. D. Aird. *Modern Industrial Press,* v. 6, Dec. '44, pp. 16-18.

When the military services became the one and only customer of the nation's auto plants they inaugurated many widespread and fundamental changes in products and production in transforming machines geared to production for civilian use to the task of providing material for war.

19-17. **Designing of "Trouble-Free" Dies.** C. W. Hinman. *Modern Industrial Press,* v. 6, Dec. '44, pp. 26, 28.

Here is a practical method for drawing deep shells of square or rectangular cross-sections, and with sharp corners. The same idea can be expanded for drawing other cross-sectional shapes having square corners, and to any reasonable depths.

19-18. **Low Priced Blank and Pierce Dies, II.** James Walker. *Modern Industrial Press,* v. 6, Dec. '44, pp. 38, 40, 42, 44, 46.

When given a die to construct, the die maker should not immediately order out material. When tool designs are not available, plenty of study should be given the part in order to arrive at the best construction possible, dealing with the size, shape, material to be blanked, quantity, and the way the grain should run. The latter is most important, because if the parts are to require forming after the blanking operation, the grain of the material might be affected by the die layout. Therefore, in such cases, all bends should be made to at least 20° of perpendicular to the grain, preferably 90° to the grain. To carry out this rule, sometimes the die will have to be laid out at an angle to insure the correct location of the grain.

19-19. **Hot-Forming Magnesium.** *Machinery* (London), v. 65, Dec. 14, '44, pp. 655-658.

Application of magnesium in airframe construction has been retarded in the past because of the difficulty in forming this metal to the many contours required

in plane-building. Information to overcome this difficulty should be of considerable value to airplane designers and production men.

19-20. **Shaping Aluminum With Steel Dies.** *Steel,* v. 116, Jan. 15, '45, pp. 78-79, 116, 119.

Ford defies conventional practices in making bomber parts by adapting technique acquired in fabricating steel fenders and body parts for automobiles. Stack drilling of rivet holes replaced by use of piercing dies.

19-21. **Rolling Mills and Practice in 1944, and Present Trends in Design and Operation.** G. G. Beard. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 100-103.

Little evidence of the advances made or contemplated in rolling mills and rolling mill practice due to conditions imposed by the present stage of the war. Unitemper mill; Krause cold reducing mill; design directed to specialty mills; bar, merchant and rod mills to produce better surface; changes due in cold strip rolling mills.

19-22. **Electrical Developments in the Steel and Non-Ferrous Industries.** G. E. Stoltz. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 107-108.

Rolling of flat products, such as strip, tin plate and sheet in the steel industry and brass strip and aluminum foil in the non-ferrous industry continues to develop along the line of producing still thinner gages. During the last five years, a million kva. capacity of electric arc furnaces has been installed. This has been done to supply alloy steel for munitions. Most of the installations which have been made are of large capacity furnaces using up to 15,000 kva. of transformers.

19-23. **Recent Developments as They Pertain to Rolling Mill Practice.** David McAllen Henderson. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 109-110, 158.

Temperature and time at temperature; spark testing helpful; use of electric eye; electrical handling of material.

19-24. **Universal Slabbing Mill Will Roll All Grades of Steel Including Stainless and Alloy.** A. G. Ericson. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 111-113.

Roller bearings on mill rolls; gas scarfing machine; disposal of crop ends.

19-25. **Electrical Development and Progress in the Steel Industry.** F. Mohler. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 116-118, 152.

Blooming and slabbing mills; plate mills; hot-strip mills; other mills; adjustable-voltage auxiliaries; processing lines.

19-26. **Computation of Roll Pressure in Cold Straightening of Tubes and Rods.** E. Bernhult. (*Jernkontorets Annaler,* v. 128, no. 4, April '44, pp. 137-160). *Engineers' Digest* (American Edition), v. 2, Jan. '45, pp. 23-26.

Power requirements of the straightening process proper; rolling friction between material and rolls; slid-

ing friction between piece and guide; bearing friction; idle power consumption; total power consumption. 6 ref.

19-27. **The Uni-Temper Mill and Process.** M. D. Stone. *Iron & Steel Engineer,* v. 22, Jan. '45, pp. 37-47, 67.
Operating experience on the first installation of this new mill design has shown that the product has definitely different characteristics, while operating economy is attractive. 5 ref.

19-28. **Recent Developments in Forging Practice.** W. W. Dyrkacz and L. B. Fonda. *Steel,* v. 116, Jan. 22, '45, pp. 82-84, 124.
Applications, die design, materials which may be forged, effect of composition on forgeability and heat treatment, as well as the techniques employed in plants of the General Electric Co. Advantages and disadvantages set forth.

19-29. **Deep Drawing 0.67-Inch Plate.** George R. Reiss. *Steel,* v. 116, Jan. 22, '45, pp. 92, 94, 96.
Amazing press job forecasts important revisions in manufacturing many products.

19-30. **Presses, Forging and Molding Machines.** *American Machinist,* v. 89, Jan. 18, '45, pp. 291-299.
32nd annual review of presses, benders, die casting machines, molding machines.

19-31. **The Fabrication of Magnesium Alloys.** A. W. Winston. Electrochemical Society Preprint 86-26, Oct. '44, 15 pp.
Magnesium alloyed with other metals to give it valuable mechanical and other physical properties. The specific gravity of these alloys is only slightly above that of pure magnesium. The principal additions are aluminum, zinc, and manganese. Methods of making these alloys are presented in detail. Details on casting; extrusion (requiring billets of the highest possible quality); plate and sheet rolling; forging, die casting, fabricating; and finally the importance of properly designing structural parts of these magnesium alloys, in particular when applying the high strength extruded shapes and sheet.

19-32. **Composite Die Sections Save Time and Are Economical.** *American Machinist,* v. 89, Feb. 1, '45, pp. 103-105.
Such sections have been used extensively in the automotive field but it is anticipated that industrial applications will increase after the war.

19-33. **Structural Mill at the Fontana Plant of the Kaiser Company, Inc., Has Initial Annual Capacity of 200,000 Tons.** R. M. Bickerstaff. *Blast Furnace & Steel Plant,* v. 33, Feb. '45, pp. 223-231.
General arrangement of the structural mill discussed.

19-34. **Developments in the Lay-Out of Modern Wire Mills.** *Wire Industry,* v. 12, Jan. '45, pp. 35-36.
Initial rolling treatment; wide range of sizes; different cropping operations; zig-zag train, and control of loops formed; speed allowances; reeling arrangements.

19-35. **Recent Developments in Forging Practice.** W. W. Dyrkacz and L. B. Fonda. *Steel,* v. 116, Feb. 5, '45, pp. 128, 131, 166, 168, 170.

Types of forging hammers used in General Electric Company plants as well as the products and materials involved.

19-36. **Recent Developments in Swaging.** *Iron Age,* v. 155, Feb. 8, '45, pp. 50-51.

Cable swager redesigned into a fast, automatic die opening and automatic feeding unit requiring only 3 sec. for each operation; Hydro-Former, used not only for swaging ball fittings on cable, but also for the attachment of tube to solid fittings, balls to rods, hose to flexible tubes; an all-purpose swager for attaching aircraft fittings to steel cable that is now available for general use.

19-37. **Deep Drawing of Windshields for Heavy Calibre Shells.** *Steel Processing,* v. 31, Jan. '45, pp. 26-27.

Examples of progress in deep drawing.

19-38. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, Jan. '45, pp. 31-33.

The success of a "flash butt weld" forge combination.

19-39. **Pressure Control Gage for Hydraulic Presses.** C. W. Hinman. *Steel Processing,* v. 31, Jan. '45, pp. 35, 46.

Lack of a reliable method for obtaining an exact pressure from the ram each time it advances solved by use of an indicator gage attached to a press which normally operates at 2000 to 3000 psi.

19-40. **Forging Automobile Crankshafts on High Speed Mechanical Presses.** *Steel Processing,* v. 31, Jan. '45, pp. 49-51, 60.

Cost of press offset by economy of operation, less expensive foundation, reduction in maintenance expense, increased production, etc.

19-41. **Recent Developments in Forging Practice.** W. W. Dyrkacz and L. B. Fonda. *Steel,* v. 116, Feb. 12, '45, pp. 104, 139-140, 142, 144, 146, 148, 150.

Work done on forging presses and upsetting machines in General Electric plants. Heat treatment and testing methods also described. 13 ref.

19-42. **Contour Forming 302 ¼ H Stainless Steel Channels.** Jack A. Johnson. *Modern Industrial Press,* v. 7, Jan. '45, pp. 33-34, 36.

Development of a new design for an engine mount ring, which consists of an assembly of several curved channels formed from 302 ¼ H stainless steel.

19-43. **ABC's of Stretch Forming.** J. E. De Phelps. *Production Engineering & Management,* v. 15, Feb. '45, pp. 73-76.

Up-to-date information on how the stretch press operates. How sheet stock and extrusions are handled and what happens in forming them.

19-44. **Utility of Swager Increased by Redesign.** *Production Engineering & Management,* v. 15, Feb. '45, pp. 114-115.

Design changes in swaging machines have broadened usefulness of this equipment. Examples of application to production of aircraft cable attachments indicate even further diversification.

19-45. **Huge Press Extrudes Nickel-Alloy Tubing.** *American Machinist*, v. 89, Feb. 15, '45, pp. 126-128.

Various nickel alloys will be extruded in larger tubes (Monel to 7¼ in.) opening new fields to designers needing corrosion resistant and strong cylinders.

19-46. **Forging.** *British Steelmaker*, v. 11, Jan. '45, pp. 22-27.

Change in volume; grain direction; flow of metal; instructive experiment.

19-47. **The Trentwood Rolling Mill.** *Western Metals*, v. 3, Jan. '45, pp. 30, 32, 35-36.

Huge aluminum plant attests Alcoa's faith in Northwest.

19-48. **Press Forming Possibilities of Heavy Sheet and Plate.** *Product Engineering*, v. 16, Feb. '45, pp. 125-129.

Design possibilities in stamping, forming and drawing heavy metal sheet and plate in presses are discussed. Cold work in thicknesses up to ¾ in. and hot work up to 3½ in. are illustrated in various sizes and shapes of heavy wall parts.

19-49. **Revere's Magnesium Facilities.** W. B. Griffin. *Modern Metals*, v. 1, Feb. '45, pp. 8-11.

Outline of operations at a wrought magnesium plant. Revere is developing new markets for magnesium and is well equipped to supply a variety of wrought products.

19-50. **Aluminum Baggage Compartment Nose Door.** *Modern Metals*, v. 1, Feb. '45, pp. 27-28.

Spinning of light metals is becoming an increasingly important forming method in certain applications. Ease of forming, good quality and present economies of this method, will result in more widespread usage of spun parts in the future. The nose door compartment is being spun by the Milwaukee Metal Spinning Co. for Beech Aircraft.

19-51. **Structural Mills and Structural Roll Designing.** Ross E. Beynon. *Iron and Steel Engineer*, v. 22, Feb. '45, pp. 35-52.

Describing structural mill layouts, pointing out the progress in the rolling of structural materials, and outlining some of the roll designs used in structural mills.

19-52. **Carbon Steel for the Wire Industry.** A. M. Reeder. *Wire & Wire Products*, v. 20, Jan. '45, pp. 25, 27-33.

Improvements in iron quality; bessemer steel and open hearth steel manufacture; ingot practices; austenitic grain size control; proper ingot mold practice; heating and rolling.

19-53. **Carbide Die Applications.** A. R. Zapp. *Wire & Wire Products*, v. 20, Jan. '45, pp. 35, 38-41, 83.

Development and application of tungsten carbide dies for nail mills and for cold heading operations.

19-54. **Automotive Crankshafts Forged on Mechanical Presses.** *Iron Age,* v. 155, Feb. 22, '45, pp. 62-64.

Experimental runs indicate that production is considerably higher than on the steam hammer due to the fewer number of blows required to produce a forging of satisfactory finish, while the greater simplicity of operation demands less effort and skill.

19-55. **Aluminum Fins Rolled on Aircraft Engine Cylinders.** *Iron Age,* v. 155, Feb. 22, '45, pp. 66-70.

An annual saving of 12,000 tons of nitralloy steel is being achieved by the substitution of aluminum strip rolled on edge and caulked in grooves in the steel barrel of aircraft engine cylinders. Use of deeper fins and 30% more of these results in much more effective cooling of the barrel. How new type of "W" fin is applied to Wright Cyclone aircraft engine cylinders described.

19-56. **Tinplate and Sheet Manufacturers' Section.** L. R. Underwood. *Sheet Metal Industries,* v. 21, Feb. '45, pp. 245-254.

First chapters of a new work on rolling mill theory and practice. 34 ref.

19-57. **Reactive Wire Drawing.** Kenneth B. Lewis. *Wire Industry,* v. 12, Feb. '45, pp. 79, 81.

Cone forces; the friction factor; could wire be stressed; Stringfellow's device; advantages of system.

19-58. **Rolling Precision Threads.** *Wire Industry,* v. 12, Feb. '45, pp. 87-90.

Greater speed in the production of precision threaded parts, with increased strength, improved surface finish and a more uniform product, are advantages claimed for the thread rolling process.

19-59. **Phosphate Coatings as Applied to Wire Drawing.** V. D. Smith. *Wire & Wire Products,* v. 20, Feb. '45, pp. 121-123.

Experiments with phosphate coatings show that such coatings give longer die life, impart rust resistance to wire and other advantages in wire drawing at very slight increase in production cost.

19-60. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, Feb. '45, pp. 97-99.

Records the variations of length possible under normal forging operations, which although well understood in principle have possibly been slighted in the appreciation of the wide divergence of lengths caused by thermal and forging malpractice to account for a good deal of trouble sometimes experienced with respect to length variations.

19-61. **Forming and Drawing Steel in Kirksite "A" Dies.** C. W. Hinman. *Steel Processing,* v. 31, Feb. '45, pp. 107-108.

Kirksite "A" has a very low melting point, 717° F. and its compressive strength is up to 75,000 psi. It has replaced many other materials formerly used in build-

ing certain stamping dies, and even those used in forming parts from steel. Many thousands of tons of this metal have been cast into punch and die parts.

19-62. **The Manufacture of Large Marine Engine Forgings.** Robert Liston. *Steel Processing,* v. 31, Feb. '45, pp. 109-110, 117-119, 126, 128.

Deals only with one stage of manufacture and that is the shaping or forging of the required component from the ingot under a hydraulic forging press.

19-63. **Forging.** *British Steelmaker,* v. 11, Feb. '45, pp. 68-73.

Forging round bars; mechanical properties.

19-64. **Stretch Press Forming of Aluminum.** Gilbert C. Close. *Light Metal Age,* v. 3, Feb. '45, pp. 8-11.

The fabrication of light metal sheet has been greatly advanced by employment of the stretch press, an ingenious tool which keeps both sides of the sheet under tension during bending and forming operations. Operation and methods employed with this machine are described.

19-65. **Practical Forging of Steel.** M. B. Halpenny. *Canadian Metals & Metallurgical Industries,* v. 8, Feb. '45, pp. 20-25, 45.

Hammer and press work on constructional steels.

19-66. **Further Comments on Scotland's Wire Practices.** A. P. Newhall. *Wire & Wire Products,* v. 20, March '45, pp. 193-195.

Notes published in April 1944 issue, headed "Wire Drawing in Scotland," gave rise to further comments, which will clarify the situation with respect to the mills, which are typical of Scotland.

19-67. **Relative Workability of Metals.** A. G. H. Anderson. *Wire & Wire Products,* v. 20, March '45, p. 202.

Notes on the problem of stresses involved in the deformation of metal by wire drawing.

19-68. **Formed Sheet Metal Parts Classified by Shape, I.** Mark P. Meinel. *Product Engineering,* v. 16, March '45, pp. 167-171.

Formed sheet metal parts, particularly of aluminum alloys, are classified by finished shapes in relation to the factors in design that should be considered for simplest production methods and to the many various production methods and machines that are in use. Singly curved parts and curved sections described in this article.

19-69. **Forging Propeller Hubs.** L. E. Browne. *Steel,* v. 116, March 19, '45, pp. 111, 148.

One-piece, four-arm hub, forged with the minimum finish inside and out has reduced metal loss in machining, with material savings of as much as 25 to 30% for forging.

19-70. **Diamond Dies.** *Steel,* v. 116, March 19, '45, pp. 122, 124, 127, 166.

Results of work at National Bureau of Standards sponsored by the War Production Board in developing

improved methods for producing dies for superfine wire, an essential requirement for radio and radar equipment.

19-71. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, Feb. '45, pp. 263-272.

Single impression combination tools; double and triple combination tools and combination follow-on tools.

19-72. **Semi-Finished Steel.** Ross E. Beynon. *Iron & Steel,* v. 18, Jan. '45, pp. 18-22.

Rolling methods and problems.

19-73. **Progress in Hot Cropping Operations.** A. G. Arend. *Drop Forger,* v. 24, Nov. '44, pp. 106-108. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 77-A.

The application of hot saws and the layout of forging machines in relation to the hot saw which cuts off the billets or blanks to the required size are discussed.

19-74. **Krause Reciprocating Mill as Used for Brass Rolling.** *Sheet Metal Industries,* v. 21, Jan. '45, pp. 65-67.

This unique rolling mill, with a reciprocating roll assembly, is being successfully employed for heavy reductions on wide brass strip. Indications are that it also may find application in the reduction of steel strip requiring particular physical characteristics.

19-75. **The Metadyne Electrical Control System Applied to Speed Control on Rolling Mills.** *Sheet Metal Industries,* v. 21, Jan. '45, pp. 72-74.

Tandem and reversing strip mill control. Tension regulation on winding and unwinding reels.

19-76. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 81-84, 88.

For bending and forming work a press of robust design, well supported to withstand the stresses set up in the frame, and with substantial guides to the slide, should be chosen.

19-77. **Education and Training in the Sheet Metal Industry.** A. P. M. Fleming. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 101-107, 110.

Importance of craftsmanship; education for craftsmanship; particular training for craftsmanship; adult education; the trade apprentice course at Metropolitan-Vickers Electrical Co., Ltd.

19-78. **Metal Spinning—Practice and Procedure.** *Sheet Metal Industries,* v. 21, Jan. '45, pp. 116-118, 123-125, 128.

Spinning process has decided advantages owing to the low cost of the chucks employed compared with that of press tools. Process often used in conjunction with the press, initial forming being carried out by pressing, and the more complex shaping that follows by spinning. Owing to the ease with which it can be worked, its ductility and its freedom from excessive and harmful work hardening and season cracking, aluminum is probably the most commonly spun metal.

19-79. **Indian Aluminum.** *Chemical Age,* v. 52, Feb. 3, '45, p. 125.
Rolling mills and reduction works completed.

19-80. **Change Gears Applied to Die Control Length of Slotted Parts.** G. Letche. *American Machinist,* v. 89, March 1, '45, pp. 117-118.
Compact attachment applied to the front of the die shoe is operated by a ratchet each time the punch descends, controls the cut-off.

19-81. **Tension and Power Consumption in Cold Rolling.** M. Fainberg. *Stal,* v. 1943, nos. ¾, April '43, pp. 27-29. *Engineers' Digest* (American Edition), v. 2, March '45, pp. 138-139.
Relates to a method which, by means of ordinary technical ammeters, permits the determination of the tension of the strip, even in cases where two-sided tension is employed in continuous tandem mills. It also makes possible the establishment of the load and power consumption of the individual drives.

19-82. **Pilger Mill Drive Without Flywheel.** M. Fainberg. *Stal,* v. 1943, no. 9/10, Oct. '43, pp. 36-41. *Engineers' Digest* (American Edition), v. 2, March '45, pp. 142-144.
Mathematical development.

19-83. **Dies Made From Cerrobend for Limited Production.** Kenneth C. Cathcart. *Machinery,* v. 51, March '45, pp. 139-146.
Alloy possesses physical properties that make it a suitable material from which to produce hand-forming hydraulic press and drawing dies, backing blocks, punches and pressure plates, power-brake joggle dies, and numerous other tools. Generally, these tools can be made from Cerrobend in less time than it would take to make the patterns for standard tools.

19-84. **Forging Automobile Crankshafts on High-Speed Mechanical Presses.** *Machinery,* v. 51, March '45, pp. 164-165.
Object was not so much to improve the physical quality of the forging as to produce equally good physical properties, with close dimensional accuracy, at a substantial reduction in forging cost.

19-85. **Extrusion of Copper-base and Auminum Alloys.** *Iron Age,* v. 155, March 8, '45, pp. 76-79.
Summaries of symposium scheduled for annual convention of Institute of Metals Div. and of Iron & Steel Div. of A.I.M.E. Extruding plain and tubular sections of copper-base alloys. Factors affecting the rate of extrusion of aluminum alloys.

19-86. **Electric Arc Hot Tops Reduce Ingot Losses in Producing High Nickel Alloys.** John D. Knox. *Steel,* v. 116, March 12, '45, pp. 106-107, 126, 128.
Lime glass maintained in molten state on top of ingot for about 12 min. minimizes croppage. First mills of cluster type built in this country to roll wide sheets are still in service. Extrusion press of 4000 tons ca-

pacity makes possible the extrusion of high nickel alloys. Manufacture of Monel metal described in detail.

19-87. **The Universal Slabbing Mill at Homestead.** A. G. Ericson. *Iron and Steel Engineer,* v. 22, March '45, pp. 35-46.

Innovations in rolling mill which are well worth considering.

19-88. **Spinning Aluminum.** E. H. Benson. *Aluminum & Magnesium,* v. 1, Feb. '45, pp. 28-29, 36-37.

Aluminum is easier to spin than other non-ferrous metals and requires less mechanical skill to avoid scratching with the risk of fracture on a deep spinning. It requires less annealing or forming operations and is one of the most workable of commercial metals.

19-89. **Modern Forge Shop.** Frank M. Scotten. *Production Engineering & Management,* v. 15, March '45, pp. 89-92.

Use of forging presses, induction heating units, and continuous conveyor-type furnaces indicates extent of modernization in Oldsmobile division.

19-90. **Mill Built for Russia; Can Roll Billets, Strip, Rounds or Squares.** *Blast Furnace and Steel Plant,* v. 33, March '45, pp. 350-354.

Flow diagrams indicate the movement of material when different types of products are being rolled.

19-91. **The Modern Ingot Buggy With Amplidyne Control.** R. E. Marrs. *Blast Furnace and Steel Plant,* v. 33, March '45, pp. 355-359.

Vehicle for the conveyance of uniformly hot ingots from soaking pit furnaces to the entry table of a rolling mill. Function of this buggy in the maintenance of production schedules on a modern rolling mill is a most important one and the selection of its drive and control deserves careful study.

19-92. **The Rolling of Metals; Theory and Experiment.** L. R. Underwood. *Sheet Metal Industries,* v. 21, March '45, pp. 429-436.

Forward slip. 17 ref.

19-93. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, March '45, pp. 449-452.

Design for a double impression combination washer tool shown, for producing washers from copper strip 0.085 in. in thickness. Owing to the weight of the coil and the thickness of the material, a very robust and rigid stock reel is necessary at both the feed end and the scrap delivery end of the press.

19-94. **Electric Drives for Power Presses.** *Sheet Metal Industries,* v. 21, March '45, pp. 453-455.

Combined effect of the necessity for high-speed working and the widespread introduction of female labor has thrown into relief the supreme advantages of electrical operation.

19-95. **Drawing Tungsten and Molybdenum Wire.** Irwin H. Such. *Steel,* v. 116, March 26, '45, pp. 90-91, 110.

Chemical compounds are converted into wire as small as 0.00055 in. in diameter in process requiring drying furnaces, hydraulic presses, sintering furnaces, swaging machines, draw benches and miniature drawing and annealing equipment.

19-96. **Photographic Layouts.** A. R. Eckberg and H. C. Staehle. *Steel,* v. 116, March 26, '45, pp. 92-93, 122, 124, 126.

New process developed for sheet-metal industry, to replace templates.

19-97. **Drawing It Out Fine.** Robert L. Zhour, *Scientific American,* v. 172, April '45, pp. 232, 234.

Wire drawing today is a complex series of precise operations which depend upon accurate dies and the careful regulation of lubricants and drawing speeds. The drawing of fine wires necessary in many electronic devices is expected in itself to grow into a major industry.

19-98. **Rolling and Drawing Brass.** *Aluminum and the Non-Ferrous Review,* v. 9, July-Sept. '44, pp. 39-40.

Successful rolling and drawing of brass for the production of different engineering sections is largely influenced by the type of oil which is selected. It is not merely the friction which might tend to increase at the roll neck, but the direct reduction in output, and adverse appearance of the metal surface when an inferior oil is employed.

19-99. **Marine Engines.** Robert Liston. *Iron and Steel,* v. 18, Feb. '45, pp. 69-72.

In this paper, taken from the *Journal* of the West of Scotland Iron and Steel Institute, the shaping or forging of the required component from the ingot under a hydraulic forging press is dealt with.

19-100. **Mechanical and Metallurgical Advantages of Shot Peening.** O. J. Horger. *Iron Age,* v. 155, March 29, '45, pp. 40-49, 100, 102, 104.

An engineering appraisal of the technical and economic utility of compressing the surface layers of design members as a means of greatly improving their fatigue resistance. In this first section of a two-part article, the author details the history of shot peening, describes the treatment of coil and leaf springs, sandblasting effect on fatigue, tempering after peening, and the peening of torsion springs and drive shafts. 37 ref.

19-101. **Fixture Facilitates Positioning of Large Punch Press Dies.** K. B. Jamison. *American Machinist,* v. 89, March 29, '45, p. 105.

Methods used formerly in setting heavy dies in place in punch presses have been discarded in favor of a handling fixture which reduces hazards of damage and injuries to hands of workers.

19-102. **Induction Heating at Timken Forge**. P. D. Aird. *Modern Industrial Press,* v. 7, March '45, pp. 13-14, 16.

Promises to change materially the whole concept of heating steel for forging operations.

19-103. **Designing of Trouble-Free Dies.** C. W. Hinman. *Modern Industrial Press,* v. 7, March '45, p. 22.
Drawing first and second operation shells.

19-104. **Shot for Metal Peening.** Oscar E. Harder and James T. Gow. *Steel,* v. 116, April 2, '45, pp. 111-112, 172.
Materials used in metal peening include chilled iron shot, malleableized chilled iron and a special heat treated shot. Third type has improved resistance to fracturing and hardness ranges suitable for majority of applications. Steel shot is costly and generally not available.

19-105. **Mechanical and Metallurgical Advantages of Shot Peening.** O. J. Horger. *Iron Age,* v. 155, April 5, '45, pp. 66-76, 146, 148-149.
Appraises the technical and economic utility of compressing the surface layers of design members as a means of greatly improving their fatigue resistance. Control of shot peening, treatment of light alloys, shot size and time, liquid blast, and the peening of gears, tank parts and crankshafts. 10 ref.

19-106. **British Investigations Into Reactive Wire Drawing.** F. C. Thompson. *Wire Industry,* v. 12, March '45, p. 135.
British counterpart to the researches described last month by Kenneth B. Lewis.

19-107. **Wire Rope Manufacture.** *Wire Industry,* v. 12, March '45, pp. 139-140.
Production methods at Macwhyte.

19-108. **Stretch-Forming Aircraft Components.** *Machinery* (London), v. 66, Feb. 15, '45, pp. 165-169.
De Havilland methods on light-alloy sections.

19-109. **Production of 8-In. Shells at Christy Park Works of National Tube Company.** Alan B. Salkeld. *Steel Processing,* v. 31, March '45, pp. 164-167, 194.
Billet separation and conveyance; pre-heating furnace; billet heating; piercing press; draw bench; cooling and inspection.

19-110. **Quality Control in a Forge Shop.** John Mueller. *Steel Processing,* v. 31, March '45, pp. 168-172.
Quality control must be carried out as an independent function, responsible to the factory manager. Requirements of personnel organization, chief inspector, and layout man.

19-111. **Greater Output Through Application of Modern Press Design.** R. W. Glasner. *Steel Processing,* v. 31, March '45, pp. 173-175, 194.
Development and advantages.

19-112. **Seven-Roll Round Straightener.** *Steel,* v. 116, April 9, '45, p. 109.
Has unusual combination of rolls; trues up bars or tubing in level passline; removes elliptical sections of workpiece; imparts surface polish by pressure of rolls.

19-113. **Replaces Seamless Tube Mill in Ten Weeks.** *Steel,* v. 116, April 9, '45, pp. 125-126, 128.

Modern unit produces tubes 2⅞ to 7⅝ in. diameter. Large sizing mill is first of its size to be equipped with over-hanging rolls and roller bearings. Cut-off machines built with four cropping units which operate in unison and crop four ends simultaneously. Tubes arrive in inspection department in minimum of time.

19-114. **Development of Aluminum Alloy Forgings and Stampings.** J. Towns Robinson. *Metallurgia,* v. 31, Feb. '45, pp. 182-186.

Of the manipulative processes that have assisted in increasing the usefulness of aluminum alloys, not the least important are forging and stamping. Briefly surveys progress in this field up to the present high standard of production.

19-115. **Selection of Bar Steel Used As-Rolled or Drawn.** John H. Frye. *Metal Progress,* v. 47, March '45, pp. 497-504.

Cold finished bars; effect of cold drawing on tensile properties; use of fractional draft; aging effects; determination of yield strength; strain annealing; cold drawn shapes.

19-116. **Marine Engines.** Robert Liston. *Iron and Steel,* v. 18, March '45, pp. 105-108.

Manufacture of large forgings.

19-117. **Metal Forming With Plastic Punches.** G. H. P. *Machinery* (London), v. 66, March 15, '45, pp. 277-283.

Use of plastic punches in combination with zinc alloy dies has proved that important advantages can be derived from this practice. Plastic punches will form metal parts in zinc alloy dies more consistently than the lead punches formerly in use.

19-118. **Aluminum Forgings.** S. V. Malcuit. *Metal Industry,* v. 66, March 23, '45, pp. 186-188.

Aluminum forgings are primarily used in parts heavily stressed in fatigue and impact. Provides recommendations for achieving high quality forgings and at the same time simplifying their production. (From *Metals and Alloys.*)

19-119. **Dimpling Tool for High Strength Aluminum Alloys.** *Iron Age,* v. 155, April 12, '45, p. 67.

Martin spin dimpler for dimpling hard and brittle sheet metals such as Reynolds 301-T, Alcoa 75S-T aluminum alloys and the new light weight magnesium alloys.

19-120. **Formed Sheet Metal Parts Classified by Shape, II.** Mark P. Meinel. *Product Engineering,* v. 16, April '45, pp. 241-244.

Critical design factors are listed for contoured flanged parts of non-uniform cross-section and for double curvature parts.

19-121. **Extrusion of Nickel Alloys Now Possible in This Country.** H. M. Brown. *Machinery,* v. 51, April '45, pp. 162-169.

Technique employed in extruding large tubes in a 4000-ton hydraulic press by a process that reduces scrap loss to a minimum.

19-122. **Shot Peening Now Widely Used for Increasing Fatigue Resistance.** Charles O. Herb. *Machinery,* v. 51, April '45, pp. 170-179.

Process that in the days before the war was employed primarily for strengthening springs is now applied to a wide variety of parts, including gears, crankshafts, connecting-rods, and even aircraft propeller blades.

19-123. **Punching.** William C. Tucker. *Machine Tool Blue Book,* v. 41, April '45, pp. 135-136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158.

Pertains to punching, punching tools, and punch machines.

19-124. **Seamless Tubes Made in Mill of Latest Design at Plant of Pittsburgh Steel Company.** *Blast Furnace & Steel Plant,* v. 33, April '45, pp. 464-468.

New mill designed to roll tubes in sizes from 2⅞ to 7⅝ in. outside diameter in a wide range of wall thicknesses and lengths. Its design and layout permit straight line, high speed production, and its oversize operating parts mounted in extra heavy anti-friction bearings make possible the rolling of material to much more exact dimensions.

19-125. **Flanging Tubes.** *Iron and Steel,* v. 18, March '45, p. 108.

Using a flange rolling machine, time for forming and cutting off tubing is reduced to about two minutes. The metal is working continuously during heating and forming, producing uniform results.

19-126. **Roll Forming of Magnesium Alloys.** John M. Thompson. *Iron Age,* v. 155, April 26, '45, pp. 53-55.

Forming of magnesium sheet into structural shapes by the Yoder roll forming method. Results of tests indicated that the alloy AM-C52S-O, or its equivalent Fs-la, had the optimum combination of compressive yield strength and formability. It was found that the yield strength of this alloy could be increased an appreciable amount by stretching, the increase being proportional to the percentage of stretch imposed upon the material.

19-127. **Roller Leveling Increases Output in Rubber-Press Department.** Frank Kubichek. *American Machinist,* v. 89, April 26, '45, pp. 102-105.

Most of the trouble arising from warpage of aircraft parts formed in rubber tooling can be avoided by heat treating the blanks and then flattening them by machine.

19-128. **Use of Sheet Magnesium Alloys Expanded by Hot-Forming Method.** Paul Hawley. *American Machinist,* v. 89, April 26, '45, pp. 106-107.

Heated dies assist in solving the problem of contour forming spoilers from magnesium alloys.

19-129. **An Introductory Study of the Mechanism of Plastic Deformation of Metals.** James L. Erickson. *Light Metal Age,* v. 3, April '45, pp. 12-15.

Knowledge of the principles of plastic deformation is valuable to all industries engaged in drawing, extruding, rolling, or otherwise forming metals. Discussion of subject with particular reference to aluminum and magnesium. The basic principles apply generally to all metals.

19-130. **Spinning of Magnesium.** George F. Farley. *Light Metal Age,* v. 3, April '45, p. 21.

Metal spinning has saved tooling-up time, avoided investments for expensive dies, speeded up delivery, decreased weight, and improved the appearance of products.

19-131. **Modern Aspects of Drop Forging.** Hans Haller. *Machinery* (London), v. 66, March 22, '45, pp. 313-317.

Discusses side tapers, recesses and other forms of curvature influencing the development of the drop forging and the material waste; the splitting process.

19-132. **Forging Aluminum Cylinder Heads at Chevrolet.** P. D. Aird. *Modern Industrial Press,* v. 7, April '45, pp. 18-20, 42.

From the time the 72-lb. aluminum billet is started through the pre-forming operations until it emerges as a finished part machined with exacting accuracy, it follows a direct line, pausing only to permit some phase of manufacture to be accomplished. There are two production lines operating in the plant and never do the two come together. In this way there is no chance of mixing front and rear sections at any stage in the process.

19-133. **The Rolling of Metals.** L. R. Underwood. *Sheet Metal Industries,* v. 21, April '45, pp. 613-619, 630.

Position of the neutral point for non-uniform pressure distribution between rolls and materials; effect of rolling temperature and composition on forward slip when rolling strip steel; effect of roll diameter on forward slip when cold rolling steel strip without lubricant; effect of rolling speed on forward slip (cold rolling lubricated strip); effect of roll roughness on forward slip (cold rolling steel strip); effect of width of strip on forward slip; effect of work-hardening on forward slip; effect of tension on forward slip; effect of roll flattening on the forward slip and the no-slip angle.

19-134. **Lighting the Small Power Press.** J. H. Nelson. *Sheet Metal Industries,* v. 21, April '45, pp. 633-635, 640.

Reasons for local lighting; polished metal surfaces; lighting unit. 1 ref.

19-135. **New Precision Forging Methods.** Hans Haller. *Machinery* (London), v. 66, April 5, '45, pp. 369-371.

Other considerations of drop forging discussed, commencing with the precision profiling of parts.

19-136. **Magnesium Alloy Fabrication.** J. V. Winkler. *Metal Industry,* v. 66, April 6, '45, pp. 213-216.

American practice in the hot forming of magnesium alloy sheet described in shortened version of a paper presented to the American Society for Metals. The fact that magnesium alloy sheet has to be hot worked is,

it is claimed, an advantage since, in many cases, it allows parts to be drawn in one operation.

19-137. **Increasing the Life and Accuracy of Lamination Dies.** Guy M. Shingledecker. *Iron Age,* v. 155, May 3, '45, pp. 51-54, 135.

Experience gained in the production of electrical steel laminations at Allegheny Ludlum Steel Corp. has aided in the development of dies of long and accurate life, in the selection of suitable steels and in blanking practices.

19-138. **Constructing, Grinding and Operating Progressive Dies.** C. W. Hinman. *Steel Processing,* v. 31, April '45, pp. 238-239, 262.

Reason for the popularity of progressive dies is their high speed production economy of work material, and their trouble-free operation after being adjusted to the work. Order of die operations; precision limits; construction.

19-139. **Discussion Proceeds on Reactive Wire Drawing.** *Wire Industry,* v. 12, April '45, pp. 191-193.

An experimental machine, incorporating the principle of imparting a backward pull to prestress the wire and thus lessen the work of the die, is being built. Yield point could not be the arithmetical mean of the yield points before and after the draft, on account of age-hardening. A mild-steel wire tested at intervals after cold drawing showed a considerable increase of both the yield point and the ultimate strength.

19-140. **Light Metal Rolling.** O. Emicke. *Metal Industry,* v. 66, April 20, '45, pp. 245-246.

Power requirements in the hot and cold rolling of light metal sheet. (Translated from *VDI Zeitschrift,* v. 28, 1943, p. 435.)

19-141. **Drawing Magnesium: New Processes Applied to Forming Sheet Magnesium.** Kenneth Allen. *Production Engineering & Management,* v. 15, May '45, pp. 101-102, 104, 106.

Forming deep-drawn magnesium parts through use of mating die and punch. Blanks are pre-heated before being inserted in press.

19-142. **Increasing the Power on Existing Cold Strip Mills.** F. R. Burt and B. J. Auburn. *Iron & Steel Engineer,* v. 22, April '45, pp. 46-52.

So rapid has been the development of cold strip mills that many of the earlier mills are economically obsolete. Higher speeds, which will benefit many of these mills, may be possible of attainment through various means.

19-143. **Deep Drawing Magnesium Domes.** J. Walter Gulliksen. *Metals & Alloys,* v. 21, April '45, pp. 986-990.

New development of considerable importance to the future use of magnesium sheet is the successful technique of hot deep drawing magnesium propeller domes from heavy gage stock. Involves a whole series of press operations, including "ironing" of the sidewall,

indenting and "upsetting" as well as a "double action" draw press operation. Design of the dome, alloy, lubrication and cleaning covered.

19-144. **Forging of Magnesium Alloys.** James C. Hartley. *Light Metal Age,* v. 3, April '45, pp. 8-11, 30-31, 35.
Hammer and mechanical press forging present certain economies over more expensive methods. Description of methods for achieving best results with these methods, as well as valuable fundamental information on the subject of forging magnesium.

19-145. **Magnesium Alloy Fabrication.** J. V. Winkler. *Metal Industry,* v. 66, April 13, '45, pp. 226-229.
Technique required for hot forming magnesium alloy sheet. Claimed that it is possible to hot spin any shape in annealed magnesium alloy sheet that can be spun from pure aluminum. (From American Society for Metals.)

19-146. **Safety Is Good Business, II.** John E. Hyler. *Modern Machine Shop,* v. 17, May '45, pp. 160, 162, 164, 166, 168, 170, 172, 174.
Devices for guarding power presses.

19-147. **Deep Drawing Magnesium Alloy Sheets.** L. J. Weber and H. Vanden Berg. *Iron Age,* v. 155, May 10, '45, pp. 70-74, 142-143.
Tests made on three grades of magnesium alloys indicate that reductions in blank diameter from 50 to 55% are possible in cupping operations performed in double action mechanical presses, provided the material is heated to 500 to 550° F. In redrawing shells, reductions up to 50% are possible, giving overall reductions of 77.5%.

19-148. **Cold Heading Improves Machine Parts.** John S. Davey. *Fasteners,* v. 2, no. 1, pp. 14-17.
Process offers many advantages in production and economy.

19-149. **Methods of Increasing the Production and Improving the Operation of a Cold Rolling Mill.** T. Thiemann. *Stahl und Eisen,* v. 64, Dec. 7, '44, pp. 763-774. Iron & Steel Institute *Bulletin,* no. 111, March '45, p. 127-A.
Numerous improvements to the equipment of a mill for cold rolling, annealing and pickling coils of strip are described and illustrated.

19-150. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, April '45, pp. 636-640.
Correct die clearances; setting stops and safety stops; setting the tools—danger of and damage through oversetting; choosing the press—press speed.

19-151. **Stretch Forming Developments.** *Modern Metals,* v. 1, May '45, pp. 19-20.
Stretch-forming is rapidly becoming a popular method where close tolerances of special contour panels must be maintained. Offers some unusual advantages in the manufacture of automobile parts, after the war.

19-152. Aluminum Press Forgings by Chevrolet. Frank J. Oliver. *Iron Age,* v. 155, May 17, '45, pp. 48-55.

Manufacture of forged aluminum aircraft engine cylinder heads exemplifies some of the techniques of press forging of large components. Some of the practices worked out on other aircraft parts while awaiting the go-ahead on the job for which an unusual array of heavy press equipment was installed.

19-153. Stamping Light Metals. *Modern Metals,* v. 1, April '45, pp. 4-6.

Many firms have become familiar with working aluminum and magnesium during this war. They have produced parts to close tolerances and have found that light metals are easy to fabricate and economical to use.

19-154. Light Metal Rolling. O. Emicke. *Metal Industry,* v. 66, April 27, '45, pp. 263-264.

Power requirements involved in rolling light metal sheet. Results obtained from hot rolling and their applicability in practice.

19-155. Shot-Blasting. *Automobile Engineer,* v. 35, April '45, pp. 163-164.

Developments in the technique for increasing fatigue strength.

19-156. Stretch-Forming Aluminum with Plastics Dies. L. R. Miller. *Pacific Plastics,* v. 3. May '45, p. 15.

Stretch-forming aluminum has advanced in its outstanding efficiency by the use of cast phenolic dies. Utilization of cast plastics has saved hours of die fabrication and has cut time for securing the desired formed part.

19-157. Snap-Assembly Construction. *Steel,* v. 116, May 21, '45, p. 122.

Die-formed sheets and framing in wide variety of sizes are made with special flanged edges and channels that interlock to provide unusually strong unit without space-consuming reinforcement.

19-158. Large Extrusions Replace Forgings in Making Inner-Wing Spar Caps. J. W. Reis. *American Machinist,* v. 89, May 24, '45, pp. 106-108.

In tests with various aluminum alloys, it was found that 75S gave the greatest strength. A close metallurgical control is kept over the large extrusions.

19-159. Reducing Press Shop Scrap. *Production and Engineering Bulletin,* v. 4, April '45, pp. 133-136.

Effect of lubrication, cleanliness, speed, and type of presses on drawing operations.

19-160. Piercing Steel Tubes. *Production and Engineering Bulletin,* v. 4, April '45, pp. 137-139.

20-ton power press adapted for the job.

19-161. Fabrication of Wrought Aluminum Alloys in the Aircraft Industry. Max E. Tatman and Stuart Martin. *Western Metals,* v. 3, May '45, pp. 12-14.

Technical advances in the metallurgical and metal forming fields. Development of several new high-

strength aluminum alloys which have been used to increase the structural efficiency of newer aircraft.

19-162. **Steel Wire Manufacture.** *Wire Industry,* v. 12, May '45, pp. 247-248.

Raw material testing; initial patenting or conditioning heat treatment; cleaning and pickling; inhibitors; final patenting process; cold working; final patenting heat treatment.

19-163. **Nosing 8-Inch H. E. Shells on a 4500-Lb. Steam Hammer.** Alan B. Salkeld. *Industrial Heating,* v. 12, May '45, pp. 780, 782, 784, 786.

Problems in shell nosing; furnace for heating for nosing; nosing operation on the steam hammer.

19-164. **Forging and Heat Treating Engine Sections at the Transue & Williams Plant.** *Industrial Heating,* v. 12, May '45, pp. 742-744, 746, 748, 750, 752, 754, 756, 758.

Streamlined plant layout and specialized equipment applied to production of heavy aircraft engine crankcase forgings for war suggest innovations in shop planning that promise improved operating conditions, simplified handling and smoother flow of materials in peace-time plants.

19-165. **Metallurgical Aspects of Alloy Steel Aircraft Engine Forgings.** A. J. Pepin and A. L. Rustay. *Metal Progress,* v. 47, June '45, pp. 1107-1114.

Steel yard; laboratory acceptance testing; shear department; die department; forge shop; heat treatment shop; inspection and testing; salvage.

19-166. **Sheet Forming Methods; Their Effect on Part Design.** Mark P. Meinel. *Product Engineering,* v. 16, June '45, pp. 374-377.

Possibilities and limitations of 12 general methods of forming sheet aluminum parts and factors affecting selection of a suitable forming method for a specific design.

19-167. **Impact Extruded Aluminum Parts—Their Design and Production.** Marcus A Fair. *Product Engineering,* v. 16, June '45, pp. 402-406.

Impact extruded aluminum and aluminum alloy parts; features of design that can be produced, and scope and limitations of the extrusion process described to indicate when and how designers can use extrusion.

19-168. **Template Die Method Simplifies Tooling.** *Production Engineering and Management,* v. 15, June '45, pp. 73-76.

New type punch and die assembly for blanking and piercing is constructed directly from templates. Advantages in the use of template dies are elimination of machine work and reduction of tooling time.

19-169. **Iron Mortar Absorbs Vibration of Rolling Mill Equipment.** John D. Knox. *Steel,* v. 116, June 4, '45, pp. 118, 120.

Improved grout with high early compressive strength and capable of being flowed between foundation and

bedplate withstands hammering action under severe operation. Dispersion agent lowers water required for cement, increasing strength and reducing amount of correction necessary in initial volume change.

19-170. **The Rolling of Metals: Theory and Experiment.** L. R. Underwood. *Sheet Metal Industries,* v. 21, March '45, pp. 429-436.

For rough rolls the slip increases somewhat for drafts up to about 2 mm. but above this the reverse is the case. For smooth rolls the slip has almost the same maximum value for the three initial heights of bar. The slip is greater for rough rolls than smooth. 17 ref.

19-171. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, March '45, pp. 449-452.

Design for a double impression combination washer tool.

19-172. **Electronic Devices on Winding Reels for Metal Strip.** J. H. Hopper. *Steel,* v. 116, May 28, '45, pp. 132, 135.

Motor armature voltage is set in proportion to line speed which in turn can be regulated to conform to different gages of strip. Constant armature current is maintained as the size of coil increases and the motor slows down, thus providing constant tension on the strip during winding operation.

19-173. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, May '45, pp. 299-301.

Fabricating methods used to manufacture different types of forged hooks.

19-174. **Mass Production of Aircraft Expanded Through Increased Use of Stampings.** *Steel Processing,* v. 31, May '45, pp. 302-304.

Results giving comparative analysis between the conventional method (machining an aluminum alloy forging) and an alternate method (a steel stamping).

19-175. **Heating Furnaces in New Oldsmobile Forge Plant of Modern Design and High Capacity.** *Industrial Heating,* v. 12, June '45, pp. 928-930, 932-934, 936-938, 940, 942, 944.

Covers the equipment installed in the hammer shop, and describes the hammers, heating furnaces and other equipment employed in forging bomber parts, axles for transport equipment and miscellaneous forgings.

19-176. **Soft Dies—Hard Jobs.** Fred P. Peters. *Scientific American,* v. 172, June '45, pp. 357-358, 360.

Developed originally by the aircraft industry to improve design flexibility, speed production, and lower die cost for short-run work, the use of zinc alloy dies for sheet-metal forming has established itself as permanent tooling and is invading other fields as well.

19-177. **Energy Consumption in Hot Rolling.** G. Wallquist. *Jernkontorets Annaler,* v. 128, 1944, pp. 249-306, 309-369. *Engineers' Digest* (American Edition), v. 2, May '45, pp. 232-236.

Reference is made to actual tests and operating experiences encountered in Sweden and in other countries.

19-178. **The Rolling of Metals: Theory and Experiment.** L. R. Underwood. *Sheet Metal Industries,* v. 21, May '45, pp. 806-809.

Effect of tension on forward slip when rolling nonferrous strip; backward slip; variation of the no-slip angle across the bar or sheet; possibility of the neutral point being in reality a neutral zone. 53 ref.

19-179. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, May '45, pp. 819-820.

Ejecting the product; use of air for removal of product from the press.

19-180. **New Wire Rewinding Equipment Triples Production.** P. Somerville, L. R. Hunt, and J. C. Campbell. *Steel,* v. 116, June 11, '45, pp. 144, 147, 192.

Mechanical improvements on wire rewinding lines and adoption of electronic control of drive result in an increase in wire speed to bobbins as well as a constant wire speed throughout full bobbin buildup. New and old methods of bobbin winding compared.

19-181. **Wire Drawing.** *Metal Industry,* v. 66, May 11, '45, pp. 295-296.

Production of shaped sections in brass and copper.

19-182. **Fabrication of 75S—Ultra Strength Aluminum Alloy.** Gilbert C. Close. *Light Metal Age,* v. 3, May '45, pp. 8-11.

Processing methods for the new high strength aluminum alloys 75S.

19-183. **Rolling Aluminum Sheet at Trentwood.** Roy Fellom, Jr. *Light Metal Age,* v. 3, May '45, pp. 12-13.

Pictorial presentation.

19-184. **A Unique Method of Developing and Applying Time Standards to Parts Formed on Conveyor Table Single-Action Hydro Presses.** Ralph Sumner. *Modern Industrial Press,* v. 7, May '45, pp. 36, 38.

Method is limited to parts all of which are approximately the same size.

19-185. **The Pressing of Sheet Metal.** A. W. Swift. Junior Institution of Engineers *Journal,* v. 55, Feb. '45, pp. 109-135. Iron and Steel Institute *Bulletin,* no. 112, April '45, p. 150-A.

19-186. **Shearing.** Wm. C. Tucker. *Machine Tool Blue Book,* v. 41, June '45, pp. 147-148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170.

Confined primarily to the process of straight shearing.

19-187. **Light-Alloy Rolling-Stock.** *Light Metals,* v. 8, May '45, pp. 222-245.

Review of world practice during the period 1910-1940. 32 ref.

19-188. **Intermittent-Acting Mills for Rolling Strip.** J. B. Keller. *Steel,* v. 116, June 18, '45, pp. 108-109, 120, 123, 126.

Operating principle differs from conventional mills in that roll motion and pressure are produced by action of reciprocating cam plates. Delivery speed of Krause mill ranges from 25 to 30 ft. per min. Lateral spreading and cracking of edges are low under heavy reduction.

19-189. **Phantom Laminations.** D. R. Hull, H. F. Silliman, and J. R. Freeman. *Metal Industry,* v. 66, June 1, '45, pp. 338-341.

Sheets used for cartridges for rifles or artillery charges do not receive the same degree of rolling and annealing as do normal brass sheets. A type of "ghost" defect appears in the thicker materials which is attributed to insufficient annealing. (From A.I.M.E.)

19-190. **Bar and Tube Straightening.** Walter Siegerist. *Iron and Steel,* v. 18, May '45, pp. 160-163.

Theory and methods of modern two, four and six-roll equipment.

19-191. **Drawing Aluminum Containers for 5-inch Naval Cartridges.** G. B. A. *Machinery* (London), v. 66, May 10, '45, pp. 501-504.

Stages in the production of drawn aluminum shells having a length-to-diameter ratio of six. Thickness of the original blank was maintained during most of the drawing stages.

19-192. **Consolidation of the Surface Layer Through Pressure.** O. Foppl. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 556-557.

19-193. **Quarter-Size Dies.** John A. Cole. *American Machinist,* v. 89, June 21, '45, p. 95.

Simplify press tool development.

19-194. **Intermittent-Acting Mills for Rolling Strip.** J. D. Keller. *Steel,* v. 116, June 25, '45, pp. 135-136, 139, 173-174.

Evans-type mill designed to reduce strip between large roll and migratory rolls. Strip is pulled through Kessler-type mill housing large non-driven roll, stationary platen and small rollers. Proposed intermittent-acting mill employs small planetary rolls which circle about large central roll.

19-195. **The Fundamentals of Tool Engineering, II—The Extrusion of Hard Metals.** *Tool Engineer,* v. 14, May '45, pp. 22-23.

Permits infinite variety of shapes; press forging.

19-196. **Steel for Cold Heading.** J. R. Thompson. *Fasteners,* v. 2, no. 2, '45, pp. 10-13.

Successful production of wire for cold heading requires careful control at all stages in the process of its manufacture, from the charging of the blast furnace down to inspection and testing of the finished material.

19-197. **Trends in Aluminum Fabrication.** J. C. Millson. *Canadian Metals & Metallurgical Industries,* v. 8, June '45, pp. 24-28, 49.

Reduction, remelting, casting, rolling, extrusion, forging, welding, brazing.

19-198. **Studebaker Shot-Peening Technique.** *Automotive Industries,* v. 92, June 15, '45, pp. 19, 96.

Details of the shot-peening technique for improving the fatigue life of highly stressed aircraft engine connecting rods.

19-199. **Production of Dies for Armature Laminations.** *Machinery* (London), v. 66, May 24, '45, pp. 557-562.

Typical set of press tools for armature laminations is shown. Tools are of the follow-on two-station pattern, punch first of all coming into action to cut the necessary slots and the center hole in the strip material.

19-200. **The Krause Mill Reduction Line.** P. M. Mueller. *Iron and Steel Engineer,* v. 22, June '45, pp. 37-46, 57.

Performing a very heavy reduction in a single pass, this mill may fit into a continuous production line with equipment for cleaning, annealing, etc. Experience with two units on non-ferrous production indicates possibilities for the steel industry.

19-201. **Billet Preparations for Rolling Mills.** F. F. Cambest. *Iron & Steel Engineer,* v. 22, June '45, pp. 59-61.

Conditioning is vitally important in the production of high quality products. The best method of conditioning is the prevention of defects in the preceding steps of the process.

19-202. **West Coast Steel Mill.** G. Eldridge Stedman. *Steel,* v. 117, July 2, '45, pp. 108, 110, 158.

Bar and merchant shapes are produced in modern mill.

19-203. **Properties and Workability of 75S Aluminum Alloy.** M. Raskin. *Product Engineering,* v. 16, July '45, pp. 481-483.

Discussion of the heat treatments and forming limitations of high strength 75S aluminum alloy as compared to the 24S alloy, and methods by which difficulties are overcome.

19-204. **Drawing and Ironing ½-In. Magnesium Plate.** J. Walter Gulliksen. *Iron Age,* v. 156, July 5, '45, pp. 74-77.

By heating the magnesium plate to a temperature between 500 and 600° F., it has been found possible to successfully form a domed cup with 52½% reduction in one draw from a ½-in plate. Wall thickness was then reduced 37% by an ironing operation. A complete analysis of all the factors involved is given.

19-205. **The Rolling of Metals: Theory and Experiment.** L. R. Underwood. *Sheet Metal Industries,* v. 21, June '45, pp. 983-991.

Hot rolling tests on ferrous bars; hot rolling tests on aluminum bars; cold rolling tests on aluminum bars; cold rolling tests on copper bars; cold rolling tests on copper strip; cold rolling tests on lead bars;

flow of material in cold rolling mild steel strip; discussion of methods for investigating the flow of material in rolling.

19-206. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 21, June '45, pp. 1003-1006, 1010.

Compound tools; blank, draw and pierce tools; blank, raise and pierce tools.

19-207. **Tube Fabricating Techniques.** J. S. Adelson and Park Hill. *Steel,* v. 117, July 9, '45, pp. 118, 174.

Precisely fabricated tubular parts will be within reach of most designers for peacetime manufacturing because producers and fabricators are emerging from war experience well equipped to surmount technical difficulties.

19-208. **Hardfaced Dies.** M. Riddihough. *Iron & Steel,* v. 18, June '45, pp. 189-190.

Longer life in hot stamping and drawing operations.

19-209. **Bar and Tube Straightening.** Walter Siegerist. *Iron & Steel,* v. 18, June '45, pp. 199-203.

Theory and methods of modern two, four and six-roll equipment.

19-210. **Stamping and Assembly of Domestic Gas Ranges.** S. J. Szabo. *Steel Processing,* v. 31, June '45, pp. 359-363.

Operation of research laboratory of American Stove Co.

19-211. **The Design of Dies for One-Operation Forming.** C. W. Hinman. *Steel Processing,* v. 31, June '45, pp. 373-378.

Punch and die shown produce work from a flat sheet blank in one stroke of the press ram. Operation details.

19-212. **West Coast Steel Mill.** G. Eldridge Stedman. *Steel,* v. 117, July 16, '45, pp. 134, 136, 174, 176, 178.

Features modern rod mill layout. Facilities and practice at Columbia Steel Co.

19-213. **Cold Impact Extrusion of Aluminum Parts for Douglas Aircraft.** J. R. Boston. *Machinery,* v. 51, July '45, pp. 138-147.

Remarkable results obtained on standard punch presses point toward wide manufacturing economies in various industries.

19-214. **Stretch-Forming Aluminum Alloy Shapes at Willow Run.** Charles O. Herb. *Machinery,* v. 51, July '45, pp. 184-191.

Unique methods developed by Ford engineers to supply the tremendous number of stretched shapes required in building over 8000 four-engine bombers—the same methods are applicable in aluminum fabrication outside of the aircraft industry.

19-215. **Bending.** Wm. C. Tucker. *Machine Tool Blue Book,* v. 41, July '45, pp. 139-140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162.

Treats in a simple way the subject of bending rolled metal shapes on power driven bending rolls. It is im-

portant that a distinction should be made between bending and forming. These are two entirely different types of metal working, although closely related and performed on machines employing similar principles. Discussion confined to bending of metal in one plane only, that is, to produce circles, arcs and spirals.

19-216. **Toroidal Winders.** F. E. Planer. *Wire & Wire Products,* v. 20, July '45, pp. 491-493, 496.

Theory developed is regarded as the basis of toroidal winding practice.

19-217. **Production Planning for a Rubber-Press Department.** Edwin H. Schaeffer and Walton Hughes. *American Machinist,* v. 89, July 19, '45, pp. 105-109.

Attracted by low tooling cost, many concerns are interested in forming aluminum by the rubber-press method. Discusses economics involved.

19-218. **Metallurgical Problems in the Manufacture of Seamless Gun Tubes.** Joel C. Carpenter. *Metal Progress,* v. 48, July '45, pp. 67-72, 112.

Description of process; metallurgical factors; chemistry; hardenability; steelmaking practice; rolling mill practice; piercing; auxiliary operations.

19-219. **Forming Stainless Steel with Zinc Alloy Dies.** W. W. Broughton. *Metals & Alloys,* v. 21, June '45, pp. 1626-1630.

Advanced practice in using zinc alloy dies on stainless steel parts and a review of the general characteristics and uses of these inexpensive but durable die materials.

19-220. **Rolled Threads.** William T. Taylor. *Metals & Alloys,* v. 21, June '45, pp. 1643-1647.

High speed production of threads by rolling is a modern development that matches the fast production of cold headed blanks. The calculation of blank diameters for different materials, types of part (screw, stud, tap, etc.) fits, etc. is a complex problem and formulas and tables are given to aid the designer in his planning.

19-221. **Forging Magnesium Alloys.** *Metals & Alloys,* v. 21, June '45, p. 1671.

Designation; nominal chemical composition.

19-222. **Deep Drawing Filter Cases, I.** Carl J. Nagel. *Tool & Die Journal,* v. 11, July '45, pp. 98-103.

Press-working of the case for the Fram type F4 filter.

19-223. **Early Wire History.** *Wire Industry,* v. 12, July '45, pp. 355-356.

Tintern mill; first steel wire drawing; Horsfall's invention; rope wire; Atlantic telegraph cables; testing; overdrawing.

19-224. **Patenting.** *Wire Industry,* v. 12, July '45, p. 358.

Comparison of methods.

19-225. **Continuous Drawing of A. P. Shot.** C. A. Litzler. *Steel,* v. 117, July 30, '45, pp. 100, 126.

Holds down fuel consumption, provides flexible heat treating cycle.

19-226. **The Rolling of Metals.** L. R. Underwood. *Sheet Metal Industries*, v. 22, July '45, pp. 1167-1176, 1184.

Tests show that the deformation of a loosely fitting plug or screw, or one that is of a different material from the bar, may not give a true picture of internal flow. That plugs or screws are apt to be loosened during rolling is shown by Metz's tests, in which the loosening of the screws was taken as an indication of the stresses to which the material was subjected. 50 ref.

19-227. **Standard Dimpling Methods Adapted for 75S-T Aluminum Sheet.** Kirby F. Thornton. *American Machinist*, v. 89, Aug. 2, '45, pp. 106-108.

Existing equipment and methods inadequate for dimpling 75S-T sheet. Seek method which will be adaptable to a wider range of shop production conditions.

19-228. **Plastic Bending—Further Considerations.** Wm. R. Osgood. *Journal of the Aeronautical Sciences*, v. 12, July '45, pp. 253-262, 272.

General relation between moment and curvature for sections the widths of which are expressible as polynomials of any order. Specific solutions are given for five symmetric cross-sections, including two sections bounded laterally by arcs of parabolas, and for six unsymmetric cross-sections, including the triangular section and two sections bounded laterally by arcs of parabolas.

19-229. **West Coast Steel Mill.** G. Eldridge Stedman. *Steel*, v. 117, Aug. 6, '45, pp. 130, 133, 159-160, 162, 164.

Production of many different items in modern wire mill, details facilities and practice of Columbia Steel Co. near San Francisco.

19-230. **The Elements of Wire Drawing.** *Tool Engineer*, v. 14, July '45, pp. 40-41.

Types of equipment; reduction explained by geometrical progression.

19-231. **Dies Made From Cerrobend.** K. C. C. *Machinery*, (London), v. 67, July 5, '45, pp. 1-6.

Cerrobend is an alloy containing 26.7% lead, 13.3% tin, 10% cadmium, and 50% bismuth. Possesses physical properties that make it suitable material from which to produce hand-forming, hydraulic press, and drawing dies. Mechanical properties of the alloy; bending thin materials; using a part as the pattern.

19-232. **New Finish for Sheet Metal.** *Sheet Metal Worker*, v. 36, July '45, pp. 39, 72.

Rolling designs into sheet metal adds strength, lends eye-appeal and serves other useful purposes.

19-233. **Short-Cut for Making a 90° Five-Piece Reversed Oblong Transition Elbow for Fitting to a Flat Surface.** *Sheet Metal Worker*, v. 36, July '45, pp. 51-52.

Time-saving method which includes simple offsets to fittings. Only experience necessary to develop patterns by this method is the ability to draw a true plan and elevation of the fitting for which the pattern is desired.

19-234. **Bibliography on Cold Heading and Cold Forging.** *Metallurgia*, v. 32, June '45, p. 52.
List of references on the subject covering the period 1933-1943.

19-235. **Wire Drawing.** W. F. Randall. *Metal Industry*, v. 67, July 27, '45, pp. 50-52.
Methods by which the process has been speeded up. Cleaning; surface treatment and lubrication.

19-236. **Master Rod Forging at Chevrolet.** P. D. Aird. *Modern Industrial Press*, v. 7, July '45, pp. 13-14, 16.
Production of major component parts for their final assembly.

19-237. **Deep Drawing Filter Cases, Part II.** Carl J. Nagel. *Tool & Die Journal*, v. 11, Aug. '45, pp. 99-103.
Blanking and three-operation draw of the Type F-31 Fram Filter.

19-238. **Dimpling New High-Strength Aluminum Alloys.** *Western Machinery & Steel World*, v. 36, July '45, pp. 320-321.
New method utilizes a tool which fits the standard dimpling machine. Procedure is simple, inexpensive and rapid, and is easily taught to the operator. It produces strong, well-formed dimples in high strength aluminum alloys without radial or circumferential fractures.

19-239. **Dimensioning of Rough Forgings to Assure Metal for Finishing.** Frank M. Mallett. *Product Engineering*, v. 16, Aug. '45, pp. 552-553.
Method of approach and general solution of a typical problem of determining nominal dimensions and tolerances on forgings so that any combination of tolerances will leave enough material for machining.

19-240. **Production Processes—Their Influence on Design. Part II.** *Machine Design*, v. 17, Aug. '45, pp. 113-118.
Spinning; unusual shapes practical; streamlined curves advantageous; gage variation affects tolerances.

19-241. **Flexible Tools for Stamping Light Metals.** *Modern Metals*, v. 1, Aug. '45, pp. 14-15.
Developments of light metal stamping methods during this war have helped out costs of materials previously fabricated by other methods. Outlines some of the early problems and tells of some tooling developments which have aided in cutting costs for temporary or short-run jobs.

19-242. **Buick Forges Aluminum Pistons for Pratt & Whitney Aircraft Engines.** *Industrial Heating*, v. 12, July '45, pp. 1108-1110, 1112, 1114, 1130.
Forging press and dies; heating furnace for billets.

19-243. **Lubrication in the Drawing of Metals.** Samuel Spring. *Steel*, v. 117, Aug. 13, '45, pp. 108-109, 154, 156.
New data based upon original research at Frankford Arsenal which will prove useful in solving lubrication problems in the drawing of copper-base alloys. 3 ref.

19-244. **Diamond and Sintered Carbide Wire-Drawing Dies—Their Maintenance and Use.** *Industrial Diamond Review,* v. 5, July '45, pp. 145-147.

Suggestion for correct use and subsequent treatment of diamond and sintered carbide dies.

19-245. **Steel Roll Manufacture and Application.** *Industrial Heating,* v. 12, July '45, pp. 1160, 1162.

Manufacturing processes involved in the manufacture of steel rolling-mill rolls, and some of the factors determining their suitability for certain applications.

19-246. **Wire Drawing.** W. F. Randall. *Metal Industry,* v. 67, Aug. 3, '45, pp. 66-69.

Mechanism of lubrication and the design and manufacture of dies. Methods of annealing also described.

19-247. **Ultimate Shear Strength of Materials.** John E. Capell. *Tool Engineer,* v. 15, Aug. '45, p. 41.

Shear, on punches and dies, increases press capacity.

19-248. **Hot Forming Magnesium Alloy Sheet.** *Iron Age,* v. 156, Aug. 16, '45, pp. 56-61.

Hot forming of magnesium alloy sheet using electrically heated tools is showing particular efficiency. Data presented on temperatures, heating methods, types of forming, gage of material, and most satisfactory lubricants.

19-249. **Lubrication in the Drawing of the Metals. II.** Samuel Spring. *Steel,* v. 117, Aug. 20, '45, pp. 134-136, 138, 185.

Lubrication by soap dispersions in water and commercial emulsion lubricants in drawing of brass. E. G. Budd test described. 7 ref.

19-250. **Automatic Screwdown Control.** A. F. Kenyon and W. G. Cook. *Steel,* v. 117, Aug. 13, '45, pp. 124, 127-128, 170, 172-173.

Preset control applied to 132-in. reversing universal plate roughing mill arranged to automatically move the screws to preselected settings for each pass in the rolling schedule. Speed of screwdown drive is reduced as it approaches selected pass position to effect accurate stop at selected position. Equipment described and method of operation explained in detail.

19-251. **Shot-Blasting or Shot-Peening Springs and the Effect on Fatigue Life.** *Mainspring,* no. 11, Aug. '45, pp. 1-6.

Shot-peening markedly increases the fatigue life of metal parts. It is a surface phenomenon which can be removed by heating. Use of alloy steel from a fatigue point of view is not necessary in fabricating many parts. Properly applied it should save weight by allowing the use of higher stresses. Perfectly smooth surface is not necessarily the best surface to resist fatigue. Fatigue testing is the best way to evaluate shot-peening.

19-252. **Wire Drawing.** W. F. Randall. *Metal Industry,* v. 67, Aug. 10, '45, pp. 88-90.

Review of modern methods and machines.

19-253. **Reactive Wire Drawing, Part I.** Janet M. Howden and R. Winstanley Lunt. *Wire Industry,* v. 12, Aug. '45, pp. 411-413, 415.

An extension of the theory of Dr. J. Dick and its application to the energy efficiency in wire drawing. 10 ref.

19-254. **Fine Wire of Special Materials.** Robert L. Zahour. *Metals & Alloys,* v. 22, Aug. '45, pp. 403-407.

Steps in the manufacture of fine wire of nickel alloys, precious metals, etc., for precision electronic and electrical applications. 3 ref.

19-255. **Brass Strip and Sheet.** N. F. Fletcher. *Metal Industry,* v. 67, Aug. 17, '45, pp. 101-104.

Object of article is to help those who are concerned with the production of satisfactory strip and sheet, to decide what cause or causes produce the various defects which may occur in or on the surfaces of rolled brass, and so enable them to find their origin.

19-256. **Multipunch Innovations.** *Steel,* v. 117, Sept. 3, '45, pp. 132, 186.

Special templates and a new numbering device used in conjunction with multipunch presses speed production.

19-257. **Kirksite Die Craftsmen.** L. W. Smith. *Western Machinery & Steel World,* v. 36, Aug. '45, pp. 355-357.

This alloy of zinc has been the leading die material for the bulk of the forming of airfoil surfaces.

19-258. **Influence of Modern Design on Press Forging.** *Steel Processing,* v. 31, Aug. '45, pp. 494-495, 525.

Four stage completely automatic continuous-operation forging machine now producing 250 finished forgings per hour. Unusual feature of this forging method is the elimination of all manual handling. Other innovations include a rotary indexing die table, self-aligning punches and mandrel with automatic stripping, combination roller and ring dies for final drawing of the shell, automatic cooling of the punches and mandrel between each operation, and an automatic lubrication system for dies and punches.

19-259. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, Aug. '45, pp. 499-500.

To produce forgings with the proper grain flow required for strength, and to avoid cold shuts during the forging operation, it is necessary to design the forging and the forging dies so that the plastic metal is flowed to the contour of the forging without buckle in the fibering. Results of investigation of cracks and flow lines in a drop forged S.A.E. 1040 steel connecting rod.

19-260. **Cemented Carbide Reduces Cost of Cold Nosing Shells.** C. W. Hinman. *Steel Processing,* v. 31, Aug. '45, pp. 501-502.

Resistance of Carboloy to abrasion; cold nosing steel shells.

19-261. **Current Uses of Shot Peening.** K. H. Barnes. *Aero Digest,* v. 50, Sept. 1, '45, pp. 153, 155, 157.

Surface fibers are compressed; results of testing; peening methods; high fatigue resistance.

19-262. **Shot Peening as a Production Method.** K. H. Barnes. *Machine Tool Blue Book,* v. 41, Sept. '45, pp. 241-242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272.

Value of shot peening in lengthening fatigue life; new production machines cut its cost.

19-263. **Deep Drawing Filter Cases, Part II.** Carl J. Nagel. *Tool & Die Journal,* v. 11, Sept. '45, pp. 119-121.

Deep drawing press work in making the cases for Fram oil filters covers blanking and three-draw operation.

19-264. **New Fabrics of Knitted Wire.** *Aero Digest,* v. 50, Sept. 1, '45, pp. 118, 166.

Discusses some of the advantages and limitations of these fabrics, and compares them with the commonly known wire cloth.

19-265. **Producing Diamond Dies for Superfine Wires.** *Industrial Diamond Review,* v. 5, Sept. '45, pp. 196-197.

Investigation of small size diamond dies to improve manufacturing processes so that dies of higher quality could be produced in shorter time and at less cost. Inspection; European methods; National Bureau of Standards method; drilling the bell; drilling the secondary cone; polishing secondary cone and bearing.

19-266. **Special Shape Bar—What It Offers the Designer.** Richard K. Lotz. *Machine Design,* v. 17, Sept. '45, pp. 141-144, 152.

Case histories point up advantages offered by special-shape bar; deals with parts formerly made by some other process; considering the use of extruded and drawn shapes for the parts of new machines and reappraising the methods and materials used in making parts for machines now in manufacture.

19-267. **Stretch Forming of Aluminum.** Gilbert C. Close. *Modern Machine Shop,* v. 18, Sept. '45, pp. 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210.

For applications within its scope, the stretch-forming method of shaping parts offers advantages with which the tool engineer should be conversant.

19-268. **The Progress of Fine Wire Drawing.** Samuel C. Avallone. *Wire & Wire Products,* v. 20, Sept. '45, pp. 623-624, 649.

Advances since 1937.

19-269. **Wire Mesh Dies.** *Wire & Wire Products,* v. 20, Sept. '45, pp. 626-627.

New process of printing that promises to make large use of various kinds and sizes of wire mesh fabrics in the graphic arts field is described.

19-270. **Proposed Commercial Standard for Woven Wire Netting.** *Wire & Wire Products,* v. 20, Sept. '45, pp. 630-631, 647.

Purpose is to provide a nationally recognized standard of quality of woven wire netting, to enable consumers and other interested parties to know what sizes and types of woven wire netting are standard and are regularly produced in sufficient volume to reasonably assure their being readily obtainable through normal channels of trade.

19-271. **Sintered Carbide Blanking and Forming Dies.** *Wire & Wire Products,* v. 20, Sept. '45, pp. 632-633.

Multiply by 10 to 1000 the number of pieces produced per grind, save users in down time from six to eight weeks' production per year, and are expected to lower production costs on thousands of commodities.

19-272. **Some Design and Operating Features of a New Blooming Mill.** G. A. V. Russell and G. W. Fox. Iron and Steel Institute, Advance Copy, Aug. '45, 12 pp.

Design and operating features of a new 43-in. reversing blooming mill installation which has replaced a lighter mill at the Templeborough plant of the United Steel Companies, Ltd. General layout of the plant and mechanical design of the new mill: roll design and rolling practice adopted are described, and results of actual performance included. Improved auxiliaries which have been installed are a four-way hot-bloom deseamer and a new type of preheating pit furnace for ingots.

19-273. **Lightweight Stampings.** *Modern Metals,* v. 1, Sept. '45, pp. 22-23.

Stampings made from light metals will find a wide market in the days to come. Herein are pointed out some of the applications for which stampings were used during the war. The knowledge gained by metal stampers should be of great benefit to those who can use stamped light metal products.

19-274. **The Heating of Wire in Wire Drawing.** E. Siebel and R. Kobitzsch. *Stahl und Eisen,* v. 63, no. 6, '43, pp. 110-113. *Engineers' Digest* (American Edition), v. 2, Aug. '45, pp. 401-403.

Heating of wire due to strain energy; the wire temperature after passing the die; consequences of the heating of the wire.

19-275. **Rail and Structural Mill for Volta Redonda Plant Designed for Varied Output.** Charles Longenecker. *Blast Furnace & Steel Plant,* v. 33, Sept. '45, pp. 1108-1112.

The mill; hot saw; straightening machine; handling of rails; disposition of structural shapes.

19-276. **Tangent Bending: A New Method of Metal Fabrication.** *Steel,* v. 117, Sept. 17, '45; pp. 124-128.

Tangent bending is a hybrid method, a cross between press forming and straight bending in which the metal flows during the bending operation and its shape is controlled by a die. Principles of operation.

19-277. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1369-1376.

Compound tools — how to use them; adaptability of tools; setting and try-out.

19-278. **The Extrusion of 8-Inch Diameter Brass Tubing.** *Machinery* (London), v. 67, Sept. 6, '45, pp. 253-256.

Technique employed in using a 4000-ton hydraulic press.

19-279. **Short-Run Press Tools.** P. Wise. *Machinery* (London), v. 67, Sept. 6, '45, pp. 268-270.

Die sections; strippers; bottom bolsters and punches; die construction; die assembly; piercing tools; die sets.

19-280. **Hot Working Characteristics.** C. L. Clark and J. Russ. *Iron & Steel,* v. 18, Sept. '45, pp. 441-442.

Evaluation by means of hot twist tests. Interpretation of the results, the application of these, and some of the limitations of the method involved.

19-281. **Stainless Steel and Its Fabrication.** Paul F. Voigt. *Sheet Metal Worker,* v. 36, Sept. '45, pp. 58-60.
Soldering; cutting operations; punching and shearing; riveting; drawing and forming; spinning; passivation.

19-282. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, Sept. '45, pp. 560-562.
Die designer must consider certain forging rules. Forging prints must be carefully studied on questions of specifications and practicability for forging. Forging techniques must be established, and on completion of the dies the metal flow of sectional reductions must be confirmed by acid etch tests prior to actual production.

19-283. **Hot Press Forming of Heavy Steel Plates.** *Steel Processing,* v. 31, Sept. '45, pp. 574-576.
By hot working of metal at temperatures above those of recrystallization, mass production of stampings is possible. Steel with thicknesses ranging up to 3½ in. or more can be hot pressed into difficult shapes. Case histories illustrate interesting problems solved by hot pressings.

19-284. **Induction Heating Develops Widespread Application in the Forging Industry.** Seward A. Covert. *Steel Processing,* v. 31, Sept. '45, pp. 577-581.
Advantages; induction phenomenon; modern forge furnace; cost of equipment; case histories; forging propeller hubs.

19-285. **Postwar Application of Shot Peening.** A. E. Lenhard. *Modern Industrial Press,* v. 7, Sept. '45, pp. 20, 22, 40.
End result of a wider application of peening for postwar use will be: To lengthen the life of products and parts that previously had failed in service; to permit higher stresses in parts, thereby increasing efficiency with no increase in weight; to reduce the size and cost of parts by increase in fatigue resistance; to cut production costs by eliminating operations such as grinding and polishing; to use the same size parts, but made of less expensive metals and alloys.

19-286. **Deep Drawing Principles, Part II.** William Schroeder and William A. Box. *Modern Industrial Press,* v. 7, Sept. '45, pp. 24, 26, 28.
Principle of similarity as applied to deep drawn parts of simple outline; rectangular parts and shapes with irregular bases; blank development; principle of constancy of area; parts with flanges; relation of h/d to per cent reduction of diameter; multiple operation parts. 12 ref.

19-287. **Equipment Employed in Straightening Operations.** John E. Hyler. *Steel,* v. 117, Oct. 8, '45, pp. 110-111, 172, 174, 176.
Pipe, tubing, steel plate, wire, small rods and ordnance components straightened with aid of machines and fixtures of many types. Portable hydraulic unit widely used

in maintenance. Coiled tubing straightened, measured and cut automatically. Pneumatic presses effective. Roller leveler handles ¾-in. plate. 22 ref.

19-288. **Stamping and Deep Drawing Magnesium.** J. Walter Gulliksen. *Product Engineering,* v. 16, Oct. '45, pp. 687-691.
Techniques and design criteria for deep drawn and stamped parts of magnesium. Data on punching, blanking, bending, forming and drawing operations included, and case histories presented.

19-289. **Twin-Motor Drives in Hot Reducing Mills.** Frank W. Cramer. *Iron Age,* v. 156, Oct. 11, '45, pp. 58-61.
Carnegie-Illinois Steel Corp. has been using twin-motor driven rolls in blooming, slabbing, and reversing plate mills with considerable success and is considering today the installation of such equipment on cold reducing mills. Description of the development of these mills.

19-290. **Hinged Form Dies.** *Aircraft Production,* v. 7, Sept. '45, p. 424.
Improved type of tool for use on rubber press.

19-291. **Electric Equipments for a 16-Stand Tube Mill.** A. L. Thurman. *Blast Furnace & Steel Plant,* v. 33, Oct. '45, pp. 1235-1241, 1247.
Mill; application problem; electric equipment; mill operation; special tests.

19-292. **Manufacture of Fine Steel Wire and Some of its War Applications.** J. R. Thompson. *Blast Furnace & Steel Plant,* v. 33, Oct. '45, pp. 1248-1252, 1276-1277.
Role of fine steel wire as a war material. Manufacture of fine wire.

19-293. **Meehanite—an "All-Around" Die Material.** J. C. Beattie. *Tool Engineer,* v. 15, Oct. '45, pp. 34-37.
Engineered metal provides unusually wide application in die manufacture.

19-294. **Production Processes—Their Influence on Design.** Roger W. Bolz. *Machine Design,* v. 17, Oct. '45, pp. 147-152.
Die forging.

19-295. **Modernizes Barmaking Facilities.** *Steel,* v. 117, Oct. 1, '45, pp. 110-111, 145-146.
New 18-stand 10-in. bar mill now being installed at Bethlehem's Lackawanna division will have a delivery speed of 2400 fpm. and a monthly capacity of 22,000 tons. Vertical rolls prevent twisting of stock between passes. Cooling bed arranged for space formation cooling or pack annealing. Mill assures increased operating efficiency and improved quality of alloy and carbon steel bars.

19-296. **Design of Magnesium Forgings.** A. L. Rustay and F. B. Rote. *Product Engineering,* v. 16, Oct. '45, pp. 682-686.
Design and qualities of magnesium alloy forgings as affected by a new production method using both press and hammer, which makes it possible to produce more forgings from existing equipment.

19-297. **Hydraulic Stretch-Forming of Metal Parts.** Harry P. Smith. *Western Machinery & Steel World,* v. 36, Sept. '45, pp. 405-407.

In the operating cycle, loading and unloading of the work is accomplished without need for the operator to move away from the control panel at the front of the machine. This feature greatly reduces cycle time and increases the number of work pieces processed per hour.

19-298. **Deep Drawing Dies of Cemented Carbide.** W. J. Bratton. *Western Machinery & Steel World,* v. 36, Sept. '45, pp. 410-411.

Deep drawing dies of Carboloy cemented carbide are giving good results in the production of sheet metal shields for radio tubes. Some of the carbide dies have turned out over 1,000,000 pieces each. This represents 500% more drawing operations than was "expected" when the carbide dies were installed in the place of the conventional hardened steel dies formerly used.

19-299. **Cold Roll Forming of Various Sheet and Strip Metal Sections.** C. M. Yoder. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1578-1585.

Trend of manufacture using steel as produced by continuous mills, and cold forming it into structural sections; and to indicate what a tremendous saving is effected in conversion costs over the well-known hot rolled shapes. Cold roll forming will not completely replace hot rolling but the cold roll forming method will play an increasingly important part in post-war activities. (From *Iron and Steel Engineer.*)

19-300. **Sendzimir Mill Employs Caster Backing Principle.** *Steel,* v. 117, Oct. 22, '45, pp. 124, 126.

Precision cold strip mill embodying new principles for reduction of steel, aluminum and copper. Work rolls 2½ in. diameter are employed for rolling strip 50 in. wide. No backup rolls are involved. Mill is compensated for deflection. Strip free from camber. Ten mills of this type soon to be operating in this country. Lubricating system maintains rolls at uniform temperature.

19-301. **Manufacture of Fine Steel Wire and Some of Its War Applications.** J. R. Thompson. American Iron and Steel Institute Yearbook, Advance Copy, 1945, 19 pp.

Manufacture of wire ranging from $\frac{1}{16}$ in. down to 0.005 in. diameter for springs in time-fuse mechanisms, insect screening, mine-trip wire, filter screens, and all types of communications and recording devices.

19-302. **The Witter Process for the Manufacture of Shell Forgings and the Spinning Process for the Manufacture of Bombs.** J. L. Johnson. American Iron and Steel Institute Yearbook, Advance Copy, 1945, 22 pp.

Witter process starts with heated steel slug shaped like a thick tube closed at one end. Three rolls "cross-roll" or knead the heated metal to reduce the wall thickness and lengthen the slug. The resulting cup is pushed through a sizing die to give it the desired dimensions before it is machined to the finished dimensions. In the spinning process one end of a seamless tube is placed in a furnace until it is hot enough for forging. The tube is then placed in a machine which spins it at a high rate of speed. A shaping wheel or tool, rotated by frictional contact with the spinning tube, forms the desired contours.

19-303. Cold Finished Bars to Physical Property Specifications. Maurice N. Landis. *Metal Progress,* v. 48, Oct. '45, pp. 769-777.

Cold drawn bars should be used more discriminatingly to take advantage of inherent and acquired advantages over hot rolled bars. Gives exhaustive statement of mechanical properties of C1137 (X1335) after various commercial cold drawing and furnacing programs in sizes ½ to $2\frac{1}{16}$ in.; minimum specification requirements for C1000 and C1100 series.

19-304. Drawability of Aluminum Alloys at Elevated Temperatures: Part I—Deep Drawing Cylindrical Cups. Dan M. Finch, Scott Wilson and John E. Dorn. American Society for Metals Preprint 7, 1945, 30 pp.

Deep drawing properties of 3S-O, 52S-O, 24S-T, 24S-T86, 61S-T, XB75S-T and R301-T were evaluated by determining the maximum per cent draw that could be achieved by deep drawing cylindrical cups. Effects of punch radius, die radius, clearance, hold-down load, die temperature, and lubrication on drawability were studied.

19-305. Deep Drawing Aluminum Alloys at Elevated Temperatures: Part II—Deep Drawing Boxes. Dan M. Finch, Scott P. Wilson and John E. Dorn. American Society for Metals Preprint 8, 1945, 20 pp.

Results obtained for a limited number of alloys and two temperatures, 70 and 450° F., illustrate decided advantage of deep drawing box-type parts of aluminum alloys at elevated temperature. For all of the alloys tested the maximum height of the box drawn at 450° F., was greater than the maximum height of box drawn at 70° F. For the T temper alloys the square boxes drawn at 450° F. were more than twice the height of those obtained at 70° F. Improvement in drawability at 450° F. as compared to 70° F. was the greatest for the high strength aluminum alloys.

19-306. Forging Magnesium. M. M. Moyle. *Western Machinery and Steel World,* v. 36, Oct. '45, pp. 442-445.

Weight and excellent machinability recommend its use to manufacturers and designers. Methods of forging outlined. Table lists the composition and typical properties of the alloys commonly available in this country.

19-307. Conditions Affecting the Quality of Steel for Cold-Heading Dies. A. S. Jameson. *Steel,* v. 117, Oct. 29, '45, pp. 98-101, 121-122.

Many quality factors are found difficult to reduce to mathematical exactness due to inability to control variables other than the one being studied. However, correlation is shown between macrostructure and die life.

19-308. Precision Forging Press. *Steel,* v. 117, Oct. 29, '45, pp. 128, 149.

Longer die life and considerable increase in production afforded by new high speed forging press.

19-309. Forging Die Design. John Mueller. *Steel Processing,* v. 31, Oct. '45, pp. 633-635.

Various basic procedures which will assist the die designer in his efforts to reduce the die costs, and help provide a more satisfactory die life.

19-310. **Recent Engineering Developments Contribute to Greater Stamping Production.** *Steel Processing,* v. 31, Oct. '45, pp. 636-638.

Case histories where stampings have replaced machined parts and substantial savings made.

19-311. **Shot Peening—Some Outstanding Applications.** Henry Fischbeck and Phil Schmitt. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1064-1068.

As applied by Pratt & Whitney Aircraft; basic principles of the process; equipment for shot peening; settings for rocker arms.

19-312. **Some Factors Affecting the Rate of Extrusion of Aluminum Alloys.** T. L. Fritzlen, *Metals Technology,* v. 12, Oct. '45, T.P. 1851, 8 pp.

Discussion on the factors that are subject to technical control. Attempt made to evaluate effect of each factor separately. Discussed in detail under three general headings are: Characteristics of the equipment; size and structure of the ingot; and temperature of ingot, cylinder, and other parts. 11 ref.

19-313. **The Effect of Various Elements on the Hot Workability of Steel.** Harry K. Ihrig. *Metals Technology,* v. 12, Oct. '45, T.P. 1932, 29 pp.

Quantitative hot workability test has been devised and used to determine the effect of oxygen, carbon, manganese, sulphur, selenium, phosphorus, silicon, chromium, nitrogen, nickel, cobalt, molybdenum, vanadium, titanium, lead and tin on the hot workability of steels. Effects on the steels studied given. 15 ref.

19-314. **Spinning Aluminum.** *Modern Metals,* v. 1, Nov. '45, pp. 8-13.

Tells of spinning technique as employed in England, and, in addition, deals with lathes, speeds, chucks, hand tools, blanks, annealing, lubrication and the overall development. (From a Bulletin published by the Wrought Light Alloys Development Association of England.)

19-315. **Stretch-Forming Plus Impact Banishes Joggling Problems.** Douglas Hodges. *Aviation,* v. 44, Nov. '45, pp. 147-149.

By preventing irregularities and permitting closer tolerances in formed and extruded sections after bending, ingenious attachment to punch press has reduced rejections of these critical parts to 1%.

19-316. **Pilot Model Stamping Costs Reduced by Inexpensive Dies.** Ernest C. Morse. *Production Engineering & Management,* v. 16, Nov. '45, pp. 74-76.

Short run dies and spinning chucks can be fabricated from this material at a greatly reduced cost. High abrasive areas on dies can be reinforced and die life extended an appreciable amount by the use of metal facing.

19-317. **"The Sol-A-Die Process"—A Method of Forming Sheet Metal.** A. D. Johnson. *Modern Industrial Press,* v. 7, Oct. '45, pp. 16, 18, 20, 22, 44.

Process has proven so successful that it has been used on more than 500 die sets during the past 2 years to pro-

duce more than 25 million dollars worth of sheet metal parts. The bolting flange shown was formerly made in 3 parts welded together at more than twice the weight and 3 times the cost. Process also opens the doorway to low cost production of custom automobile bodies and experimental designs which have been precluded by the high cost of conventional dies, on the one hand, and the high cost of beating out auto bodies by hand over form blocks on the other.

19-318. **Short-Cuts to Higher Production.** Lloyd Lennox. *Modern Industrial Press,* v. 7, Oct. '45, pp. 47-50, 52-57.

Summarizes some of the developments which appear to have wide application.

19-319. **Annealed Aluminum Alloys Respond to Hot Forming.** George Sachs and W. F. Brown. *American Machinist,* v. 89, Nov. 8, '45, pp. 91-95.

Higher forming limits attained for certain aluminum alloys at elevated temperatures result of reaction of lubricant to heat.

19-320. **The Rolling of Metals: Theory and Experiment, Part VI.** L. R. Underwood. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1719-1724, 1736.

External friction between the rolls and the material.

19-321. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1739-1746.

Follow-on die work. Design; multiple blanking tools; follow-on blank and pierce tools.

19-322. **Shot-Peening.** *Aircraft Production,* v. 7, Oct. '45, pp. 478-480.

Improving mechanical properties by the shot-blasting process.

19-323. **Metal-Flow Presswork for Small and Large Quantities.** W. M. Chapman. *Machinery* (London), v. 67, Oct. 18. '45, pp. 429-430.

Method of manufacture described as a "metal flow" operation. All details described made from standard soft-brass sheet.

19-324. **Increasing the Life of Brick and Tile Dies.** Philip W. Tefft. American Ceramic Society *Bulletin,* v. 24, Nov. 15, '45, pp. 417-418.

Design of all-steel welded dies is discussed. By utilization of hard-metal liners and method for resurfacing them, liners can be used for months without renewal.

19-325. **Making Small Parts at High Speed.** *Steel,* v. 117, Nov. 12, '45, pp. 124-125, 186, 188.

Ford Motor Co. turns out 1500 blanks per minute on high speed press. Where material and conditions permit, speeds up to 2000 pieces per minute are reported.

19-326. **Hot Forging Practice in the Fastener Industry.** Waldemar Naujoks. *Fasteners,* v. 2, no. 4, '45, pp. 14-18.

Modern heading machines are designed for economy on small runs; many special parts can be made with present techniques without excessive tooling expense.

19-327. **Fittings Are Attached to Cable by Fast, Automatic Die-Opening and Feeding Unit for Cable Swaging.** *Steel*, v. 117, Nov. 19, '45, p. 148.

Redesigned machine delivers positive relation between cable and fitting by rotary action which works shank metal around strands. Dies need not be removed for each operation with large-end fittings.

19-328. **Increasing Fatigue Resistance by Shot Peening.** *Machinery* (London), v. 67, Nov. 1, '45, pp. 449-454.

Shot peening has increased the life of hypoid gears by as much as 600%; aircraft engine crankshafts, 900%; steering knuckles, 475%; welded joints, 310%; transmission main shafts, 520%; and helical springs, 137%. Process in which shot is thrown on work from a centrifugal wheel that revolves at high speed discussed.

19-329. **Aluminum Alloy Strain Distribution at Elevated Temperature.** George Sachs and W. F. Brown. *American Machinist*, v. 89, Nov. 22, '45, pp. 114-117.

Geometry of die, location of friction, and alloy condition are variables which determine results of hot-die stretching.

19-330. **Some Design and Operating Features of a New Blooming Mill.** G. A. V. Russell and G. W. Fox. *Blast Furnace and Steel Plant*, v. 33, Nov. '45, pp. 1373-1379.

It was recently decided to replace the existing 40-in. blooming mill at the Templeborough plant of the Steel, Peech and Tozer Branch of The United Steel Companies, Ltd., by a heavier unit. This paper describes some design and operating features of the new installation.

19-331. **Tables of Rolling Pressures and Power Requirements for Rolling Steel Shapes.** *Blast Furnace & Steel Plant*, v. 33, Nov. '45, p. 1398 plus flow sheet.

Translated and compiled by F. Waldorf from the German text published under the auspices of Vereins Deutscher Eisenhüttenleute.

19-332. **Stretch-Forming Aluminum Alloys at Elevated Temperature.** George Sachs, George Espey and W. F. Brown. *American Machinist*, v. 89, Dec. 6, '45, pp. 98-100.

Progressive forming of aluminum alloys suggested for improving forming limits under high heat.

19-333. **Selection of Die Steels for Cold Work.** W. H. Wills. *Iron Age*, v. 156, Nov. 22, '45, pp. 58-61.

Nature and physical properties of four groups of die steels used for cold work described; factors affecting their selection for specific jobs.

19-334. **Form Dies of Resin Impregnated Plaster.** John Delmonte. *Iron Age*, v. 156, Nov. 22, '45, pp. 72-74.

By means of a resin impregnating process dies and forms of plaster of paris can be made to have considerable resistance to chipping, breaking and mechanical handling such as in hydropress work.

19-335. **Flame Spinning.** *Steel*, v. 117, Nov. 26, '45, pp. 92-93.

Rapid rotation of tube end under oxy-acetylene flame, followed by closing with hard-faced forming tool or shoe, replaces slower cold-forming method and affords a superior finished chemical converter.

19-336. **Factors Affecting Die Life.** A. S. Jameson. *Steel,* v. 117, Nov. 26, '45, pp. 100-104, 106.

Characteristics of the material being cold-headed, the design of dies, the operation of the heading machines, the blank design and the quality of the workmanship which goes into the making of the dies.

19-337. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, Nov. '45, pp. 696-698.

Forgings made with impression dies include an almost unlimited variety of sizes and shapes, which involve making correct choice of various hot working processes. Selection of method assumes especial importance in any production program, because of the results such a choice has on production, machines, and materials.

19-338. **Machine Forging of Non-Ferrous Metals.** Bertram B. Caddle. *Tool Engineer,* v. 15, Nov. '45, pp. 31-33.

Corrosion resistant, and with physical properties close to steel, non-ferrous metals may be die forged to shape.

19-339. **Guerin Process of Forming Light Metals.** Roy Fellom, Jr. *Light Metal Age,* v. 3, Nov. '45, pp. 12-15.

Describes a commercial method of forming aluminum and magnesium which makes use of a pad of rubber or other resilient material on the pressing ram.

19-340. **Extruding Aluminum at Reynolds Metals.** G. W. Birdsall. *Steel,* 117, Dec. 3, '45, pp. 120-124, 126, 128, 156, 159, 160, 162, 164, 166, 168.

Huge extrusion presses develop pressures up to 5500 tons to "squeeze" aluminum through die openings to produce wide variety of shapes. Highly developed procedure also utilized for making bars, rods, tubing and hollow sections. Alloying, homogenizing and sawing precede extrusion, while heat treatment and straightening follow it.

19-341. **World's Largest Hydraulic Presses.** *Steel,* v. 117, Dec. 3, '45, pp. 130, 186.

Heavy armor plate, forgings and shafts for Navy formed by massive units exerting force of 14,000 tons.

19-342. **Stretch-Forming Aluminum Alloy Shapes.** *Machinery* (London), v. 67, Nov. 15, '45, pp. 533-538.

All stretching dies and stretch-form blocks made completely of steel; true also of all dies for mechanical and hydraulic presses. Some of the more ingenious stretch-forming methods and tools described.

19-343. **Rolling of Metals. Theory and Experiment. Part VI. External Friction Between the Rolls and the Material.** L. R. Underwood. *Sheet Metal Industries,* v. 22, Nov. '45, 1905-1913.

Coned compression tests; sliding tests; variation of the coefficient of friction between the rolls and the material along the arc of contact; Nadai's investigation; Brown's investigation. 55 ref.

19-344. **Practical Problems of Light Presswork Production.** J. A. Grainger. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1925-1932.

Follow-on die work.

19-345. **Flat Die Forging in Modern Hydraulic Presses.** C. W. Hinman. *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 199-200, 202, 204.

Press speed, tons pressure applied on the work, and ram movements, are all under control of a single hand lever. How it operates.

19-346. **Metal Spinning by Modern Methods.** Edwin Weiss. *Machinery,* v. 52, Nov. '45, pp. 141-148.

Applications in modern industry are manifold and new methods have greatly extended its scope. Step-by-step procedure in metal spinning; what metals can be spun; an example of hot spinning.

19-347. **Forging Aluminum Aircraft Pistons on Mechanical Presses.** Charles O. Herb. *Machinery,* v. 52, Nov. '45, pp. 149-152.

Forging method that differs greatly from customary procedure in the production of aluminum pistons developed by the Buick Division of General Motors Corp.

19-348. **Correct Die Design Essential in High Production.** Charles R. Cory and Harold Wilkins. *Production Engineering & Management,* v. 16, Dec. '45, pp. 67-70.

Discloses determining factors in selection of solid form dies, pressure pad form dies and draw dies.

19-349. **Sectional Construction Reduces Tool Cost.** William J. Loach. *Production Engineering & Management,* v. 16, Dec. '45, pp. 71-72.

Fatigue failure has been controlled and over-all mold costs reduced by application of multiple-part construction to nib molds.

19-350. **Die Sets and Accessories.** Karl Stad. *Tool Engineer,* v. 15, Nov. '45, pp. 21-23.

Standard, commercial units effect marked economies in die manufacture.

19-351. **Cold Metal Contour Forming.** R. A. Mackenzie. *Steel,* v. 117, Dec. 10, '45, pp. 112-113, 164, 166.

Development of general purpose bender capable of producing a wide variety of shapes in relatively short runs with consistent tool economy. Constant redesign and improvement has brought out new machines which do in one stroke and at twice the speed what older machines did in three strokes.

19-352. **Drawing Stainless Cylinders.** L. E. Browne. *Steel,* v. 117, Dec. 10, '45, pp. 116-117, 170.

Vacuum chambers for water-cooled ignition tubes drawn in two diameters by ingenious setup.

19-353. **Coining and Shaving Close Stampings.** Ernest C. Morse. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 514-516.

Tolerances of 0.002, 0.001 and even 0.0005 in. are being successfully met. Describes representative examples of coining and close tolerance stampings produced during the past few years.

19-354. **"Jewelry" Manufacturing Industry—Large Consumer of Power Presses.** Floyd McKnight. *Modern Industrial Press,* v. 7, Nov. '45, pp. 22, 24, 28.

Mechanical and air presses, drop hammers and progressive dies produce a wide range of items for the jewelry trade, all the way from pins, brooches, links and metal buckles to wedding-rings and watch-cases.

19-355. **Designing of "Trouble-Free" Dies, Part 52.** C. W. Hinman. *Modern Industrial Press,* v. 7, Nov. '45, pp. 26, 28.

Reconversion welding.

19-356. **Stretch-Forming.** Al Jacobson. *Steel,* v. 117, Dec. 17, '45, pp. 100-101, 144, 146.

Review of methods and machines for producing uniform and irregular curves in rolled or extruded aluminum shapes.

19-357. **Heat Treating, Forming, and Welding 75S Alclad, Part 2.** Mitchell Raskin. *Iron Age,* v. 156, Dec. 13, '45, pp. 59-63.

Points out precautions to be observed in forming and spot welding; describes a method of hot dimpling.

SECTION XX

MACHINING AND MACHINE TOOLS

20-1. **Tap Grading System Reduces Scrapped Threads.** C. D. Savage. *Iron Age,* v. 154, Dec. 28, '44, pp. 38-41.

Predetermining the actual cutting size of a tap for a specific material prior to placing the tap on a production job reduces scrap caused by torn and oversize threads to a minimum and has provided for selective fits to within 0.0003 in.; has also greatly increased tap life and reduced lost time attributable to premature tap failure. A series of carbide thread plug gages in steps of 0.0003 in. are used for checking the thread produced in a test block.

20-2. **Broaching Versus Milling in Manufacturing Rifle Parts.** I. A. Swidlo. *Iron Age,* v. 154, Dec. 28, '44, pp. 46-49.

Illustrates broach fixture designs and tooling for machining a small, fragile part.

20-3. **Machining Light-Alloy Castings for the Merlin Engine.** *Machinery* (London), v. 65, Nov. 23, '44, pp. 561-565.

Use of high speed routing machines, for reproducing special forms. An example of the use of such routing machines is in the production of supercharger vane rings.

20-4. **High-Cycle Milling.** J. S. H. *Machinery* (London) v. 65, Nov. 23, '44, pp. 567-570.

Milling aluminum up to 19,000 ft. per min.

20-5. **Electronic Drive Gives Old Machines New Life.** V. Mancuso. *Western Metals,* v. 2, Dec. '44, pp. 58, 60.

The Axelson Manufacturing Co. recently installed Westinghouse electronic motor drives on three 30-yr.-old Heald grinders resulting in: (1) improved quality of precision finishing; (2) vibration-free, stepless speed control over a 20-to-1 speed range; and (3) better working conditions.

20-6. **Development in Electric Drive of Machine Tools.** *Machinery* (London), v. 65, Nov. 30, '44, pp. 599-602.

Speed control by change-pole motors; stepless speed variation by alternating-current motors; stepless speed

variation, Ward-Leonard control; rectifying valves; speed control from rectified current; application to spar-milling.

20-7. **Profile Turning.** *Automobile Engineer,* v. 34, Dec. '44, p. 546.
An interesting development for machining cam forms.

20-8. **Contour Machining.** *Automobile Engineer,* v. 34, Dec. '44, pp. 549-550.
A new hydraulically operated duplicating unit.

20-9. **Progress in the Mechanisms of Production.** Lester V. Colwell. *Metal Progress,* v. 47, Jan. '45, pp. 90-93.
Materials: Basic metals; carbide tools; powder metallurgy; synthetics. Pre-fabrication of materials: Sand casting; centrifugal casting; forging and die casting; powder metal products; precision casting. Fastening of components. Machine tools and operations: High speed milling; machine tool designs; form copying machines; controls.

20-10. **Selecting Carbides for Milling.** Fred W. Lucht. *Steel,* v. 116, Jan. 8, '45, pp. 84-85, 126.
"Wrong" grade correctly used often will provide better results than "right" grade improperly handled. Five types provide optimum performance and cutter life for most milling operations.

20-11. **Pneumatic Power in the Machine Shop.** *Steel,* v. 116, Jan. 8, '45, pp. 90, 130.
Applications for pneumatic power in the machine shop have grown from conventional jobs such as hoisting, drilling, chipping, drying and cleaning machinery, to counterbalancing the weights of various machine parts, positioning heavy workpieces by actuating an indexing fixture, and for many other progressive developments. Satisfactory installations affording ease of control, greater speed and low maintenance costs will remain after war's end.

20-12. **All Teeth Are Produced Simultaneously in New Method for Cutting Gears.** *Steel,* v. 116, Jan. 8, '45, pp. 112, 135.
Radially fed form-tooth blades are capable of rough and semi-finish cutting as many as 60 to 100 or more gears per hour.

20-13. **The Gipsyqueen, II.** J. A. Oates. *Aircraft Production,* v. 6, Dec. '44, pp. 563-574.
Special fixtures for operations on the crankcase top cover; machining the camshaft; gears; final engine assembly and test.

20-14. **Spar Production, II.** Wilfred E. Goff. *Aircraft Production,* v. 6, Dec. '44, pp. 599-607.
Milling center-section booms; web production; assembly drilling.

20-15. **Postwar Design Trends in Machine Tools.** *Iron Age,* v. 155, Jan. 11, '45, pp. 54-56.
Recent announcements of the builders indicate that

greater automaticity without sacrifice of flexibility will feature models of the future. Trends in machine shop practice also covered in this review of 1944 activity.

20-16. **Broaching Vs. Milling in Manufacturing Rifle Parts.** I. A. Swidlo. *Iron Age,* v. 155, Jan. 11, '45, pp. 57-60.

Shows how broach tools are checked and describes some unconventional machines for broaching curved surfaces. Summarizes the savings in capital investment over the installation of milling machines and lists the reduction in direct manufacturing costs obtained by substitution of broaching for milling on a dozen parts of the Garand Ml rifle.

20-17. **Machining Airplane-Engine Cylinder Barrels.** *Machinery* (London), v. 65, Dec. 14, '44, pp. 645-649, 651-653.

Cylinder barrels are machined from forgings of Hiduminium alloy, a material which combines strength with lightness and good heat-conducting properties. Stages in the production of the cylinder barrel are illustrated.

20-18. **Converting a Centre-Type Grinding Machine to a Centreless Grinder.** J. Kee. *Machinery* (London), v. 65, Dec. 14, '44, pp. 662-663.

Cast iron bracket carrying the spindle upon which is mounted the control wheel.

20-19. **Negative-Rake Turning and Boring.** George M. Jalma. *Machinery,* v. 51, Jan. '45, pp. 135-146.

Development of titanium and tantalum tungsten carbides inaugurated a new field for carbide tools—the machining of steel. Northern Ordnance Inc. has conducted considerable research on negative-rake tools. Article deals with tools of that type employed in turning, boring, and planing operations.

20-20. **Broaching Applied in a Constantly Broadening Field.** O. W. Bonnafe. *Machinery,* v. 51, Jan. '45, pp. 158-162.

Broaching, once thought of as applicable chiefly to keyways and splines, is today replacing many other types of machining operations in mass production manufacturing practice.

20-21. **Precision Tooling for Mass Production.** Gerald Eldridge Stedman. *Tool Engineer,* v. 15, Jan. '45, pp. 67-70.

Ingenious machine and tool engineering results in the economical production of aluminum hydraulic valve. Western firm's automatic recessing machine features cam control through hollow spindle.

20-22. **Recent Progress in High Speed Tapping, III.** C. W. Hinman. *Modern Machine Shop,* v. 17, Jan. '45, pp. 156, 158, 160, 162, 164, 166, 168, 170, 172.

Tapping efficiency affected by weight of fixture; air-operated fixtures; fixtures for high speed tapping; circular dial feed fixtures; tapping plastics; grinding taps.

20-23. **Look for the True Rake.** M. Kronenberg. *Modern Machine Shop,* v. 17, Jan. '45, pp. 190-192, 194.
One tool angle by itself does not describe the rake of a face mill cutting tooth, or of a lathe tool, unless that angle is the resultant of three components—radial rake, axial rake, and corner angle.

20-24. **The Current Revolution in the Machining of Iron and Steel.** *Machine Tool Blue Book,* v. 41, Jan. '45, pp. 187-188, 190, 200, 202, 204.
History and applications of the milling machine.

20-25. **How to Select the Locating Surfaces in Designing Die Castings.** *Die Casting,* v. 3, Jan. '45, pp. 18-19.
In the design of any casting that is to be machined, the experienced designer usually specifies one or more surfaces against which the casting is to be located when it is gaged and machined. If he fails to do so, there is always the chance that either the castings will not clean up properly when machined or that more machining than necessary will be done.

20-26. **Wadkin 75-h.p. Heavy-Duty Wing-spar Milling Machine, Type L.Z.6.** *Machinery* (London), v. 65, Dec. 21, '44, pp. 684-688.
With hydraulic clamping mechanism, pneumatic swarf collector and hydraulic profile-milling device.

20-27. **Concerning the Installation of Automatic Lathes.** K. Schwendenwein. *V.D.I. Zeitschrift,* v. 88, March 18, '44, pp. 155-159.
Detailed analysis of the work to be performed should be made to determine if the high first cost is justified.

20-28. **Use and Care of Drills.** I. F. A. *Aero Digest,* v. '44, Dec. 15, '44, pp. 99, 138.
Poor drilling has been the greatest single cause of scrap in the aircraft industry. This article is intended to provide some helpful hints on twist drills and drilling procedures as encountered by the aircraft mechanic in the average maintenance shop.

20-29. **Modern Machine Tools.** *Aircraft Production,* v. 7, Jan. '45, pp. 43-46.
Latest additions to the range of factory plant. Duplicating; profile-turning lathe; deep-hole drilling; heavy-duty turning.

20-30. **Machining Airplane Engine Cylinder Heads.** *Machinery* (London), v. 65, Dec. 28, '44, pp. 701-707.
Methods used in the production of the "Bristol" Hercules engine. The cylinder head comprises two parts, both of which are machined from castings.

20-31. **Glass-Fabric Jig Devised for Drilling Contoured Surfaces.** Edward Prono and J. M. Butler. *American Machinist,* v. 89, Jan. 4, '45, p. 87.
Structure built-up in 19 layers used instead of metal jig for locating and drilling holes in wing part of experimental airplane.

20-32. **Direction of Cut Affects Forces in Milling.** M. Martellotti. *American Machinist,* v. 89, Jan. 4, '45, pp. 97-100.

The hand of the helix and the hand of the cut have a direct effect on design of milling fixtures.

20-33. **Well Designed Fixtures Speed Machining of Gun Mount Parts.** J. B. Miller. *American Machinist,* v. 89, Jan. 4, '45, pp. 102-106.

Set-up time reduced by 75 to 80% through tooling which positions parts accurately and holds them rigidly for machining.

20-34. **Practical Ideas.** *American Machinist,* v. 89, Jan. 4, '45, pp. 107-112.

Gage attachment helps layout scribing and inspecting. Spring clamp speeds up milling of small parts. Sub-bolster eliminates die breakage on punch press. Improved shrinking die with roller-activated jaws. Lathe die attachment for machining threaded bolts and studs. Equalizing fixture has spring-backed jaws to assist unloading. Holder and guide plate facilitate regrinding of small tool bits. Contours of large gear teeth restored by grinding. An economical method for making high speed button dies. Automatic stop prevents damage of turret lathe parts.

20-35. **Machine Tools.** *American Machinist,* v. 89, Jan. 18, '45, pp. 103-112, 117-124.

32nd annual review of boring and broaching machines, cut-off machines, drilling and countersinking, boring and gear finishing, shaving, grinding and broach sharpeners, thread and surface grinding, honing and grinding, grinding and lapping, chucking and turning, turning and milling, milling and shaping, tapping and thread rolling, miscellaneous.

20-36. **Tools and Accessories.** *American Machinist,* v. 89, Jan. 18, '45, pp. 181-212d, 212f, 212h, 212j, 212l, 213.

Review of work holders, tool holders, machine attachments, marking dies and machines, lubricant and scales, cutters, grinding wheels and dressers, measuring tools, power tools, hand tools, miscellaneous.

20-37. **Automatic Special Purpose Machine Tools of New Design.** Helmut Stein. *VDI Zeitschrift,* v. 88, nos. 17-18. April 29, '44, pp. 229-237.

Detailed description of automatic machine tools for different specific purposes.

20-38. **Correct Angles Improve Efficiency of End Mills and Side Mills.** M. Martellotti. *American Machinist,* v. 89, Feb. 1, '45, pp. 94-97.

Discusses various items to consider in selecting angles for milling.

20-39. **Special Tools Used to Machine Spherical Fits for Anti-Aircraft Gun.** *American Machinist,* v. 89, Feb. 1, '45, pp. 98-100.

Revamped boring mill and new work-holding fixtures are used to speed production of Army's powerful "stratosphere" weapon.

20-40. **High-Production Machine Tools.** *Steel,* v. 116, Feb. 5, '45, pp. 114-116, 156.

Save skilled labor and enable use of women workers.

20-41. **British Developments in Cam Turning.** *Iron Age,* v. 155, Feb. 8, '45, p. 47.

Design principles in the profile turning lathe for multiple throw automotive camshafts; each individual tool is mounted in a slide, the in and out motion of which is controlled by a master cam which rotates at the same speed as the work.

20-42. **Tooling the Automatic Screw Machine, XII.** Noel Brindle. *Modern Machine Shop,* v. 17, Feb. '45, pp. 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162.

Using attachments to eliminate secondary operations; cross drilling; revolving taps and dies; drilling attachment.

20-43. **Gage Blocks Move Into the Shop.** Karl F. Kirchhofer. *Modern Machine Shop,* v. 17, Feb. '45, pp. 168-170, 172, 174, 176, 178, 180.

Shows typical examples of their use in machine shops. Outlines additional uses.

20-44. **Machining Aircraft Engine Propeller Shafts.** *Machinery* (London), v. 66, Jan. 4, '45, pp. 1-6.

Machining operations on the forging for the propeller shaft from a forging of 3% chromium nitriding steel, having a tensile strength of more than 70 tons per square inch, and nitriding before the final grinding operations.

20-45. **Recent Developments in the Ryder No. 6 Verticalauto.** *Machinery* (London), v. 66, Jan. 4, '45, pp. 9-13.

Duplex control for Verticalauto, used when a simple part is being machined, and it is possible to do all the work at two working stations; and when the time cycle is such that one operator could not keep pace with the machine and load two parts at each indexing.

20-46. **Selecting the Correct Speeds and Feeds for Cylindrical Grinding.** S. S. Shoemaker. *Machinery,* v. 51, Feb. '45, pp. 158-160.

How speeds and feeds affect wheel action.

20-47. **Differential Hobbing Solves Spur-Gear Problem.** Victor E. Francis. *Machinery,* v. 51, Feb. '45, pp. 163-165.

Mathematical development.

20-48. **Crushing Wheels for Form-Grinding Without Special Equipment.** W. Zikel. *Machinery* (London), v. 66, Jan. 18, '45, pp. 61, 67.

In the mass-production of precision form parts, the method of forming the grinding wheel by crushing is gaining popularity. It combines accuracy with simplicity of producing the form and eliminates expensive diamonds and special equipment.

20-49. **Automatic Machine Tools Prove Their Economy.** P. W. Brown. *Production Engineering & Management,* v. 15, Feb. '45, pp. 67-70.

Comparison of production efficiency, initial and operating costs of special purpose machines and single purpose equipment is shown in experience of aircraft engine manufacturer who boosted output 2200%. The record is a tribute to machine tool industry.

20-50. **Grinding Radius.** Charles L. Hall. *Production Engineering & Management,* v. 15, Feb. '45, pp. 71-72.

Easy method of producing forming tool angles which hold their accuracy through continued regrinding.

20-51. **Production Shaping.** John E. Hyler. *Production Engineering & Management,* v. 15, Feb. '45, pp. 92-94.

Modern machine and accessory designs boost the output of the shaper, so that it is becoming a more important production tool in many shops. Tool setting and gaging devices, methods for faster setup and machine operation, and contour control indicate the trend toward improvement.

20-52. **Small-Hole Grinding With Diamond-Charged Mandrels.** Frederick C. Victory. *American Machinist,* v. 89, Feb. 15, '45, pp. 107-110.

Round, straight holes in dies and gages can be produced to tenths faster with a mandrel charged with the proper grade of diamond dust than by use of small mounted wheels.

20-53. **New Cutter Doubles Production.** W. Bader, *American Machinist,* v. 89, Feb. 15, '45, p. 121.

Polishing time on the master rods was reduced so much that special grinding was avoided.

20-54. **Special Rake Angles Used for Sintered Carbide Tools.** M. Martellotti. *American Machinist,* v. 89, Feb. 15, '45, pp. 122-125.

When choosing rake angles for milling cutters the effective rake should be kept in mind. Tells how to compute it.

20-55. **Copper Cushions Benefit Carbide-Tipped Tools.** William A. M. Welles. *American Machinist,* v. 89, Feb. 15, '45, p. 128.

The use of copper cushions under the carbide tips of cutting tools has doubled the output between grinds. Chip-breaker dimensions are governed by the material to be cut.

20-56. **Interchangeable Assembly Units Coordinated by Master Tooling.** Stanley E. Vickers. *American Machinist,* v. 89, Feb. 15, '45, pp. 129-133.

Application of the three basic elements—match plates, drill plates and construction gages—is shown for master tooling.

20-57. **Light-Duty Radial Drill Made From Standard Units.** *American Machinist,* v. 89, Feb. 15, '45, p. 134.

Light-duty radial drill unit speeds operation on the top carriage of the Army's 4.7-in. anti-aircraft gun. Sketch shows that the base and height of the light-duty drilling machine and the main support arm can be varied if necessary.

20-58. **Practical Ideas.** *American Machinist,* v. 89, Feb. 15, '45, pp. 135-140.

Adjustable swivel plate simplifies grinding of cams for automatics. Turning jacks for B-29 cabin section. Roller cutter tool cuts fuel line tubing without burring. Stop for engine lathe cross-slide useful in small shop

work. Boring-bar support avoids resetting work on radial drill. Plier vise attachment facilitates welding of rectangular parts. Vise stops facilitate production of duplicate parts. Molding of small plastic parts facilitated by special fixtures. Easily removable stop collar with counter-sunk capscrews. Insulation stripping tool eliminates wire damage.

20-59. **Favored Practice in Machining Zinc Alloy Die Castings, II.** *Die Castings,* v. 3, Feb. '45, pp. 64, 66, 68-69.
Data on threading and reaming.

20-60. **Basic Principles of Centerless Grinding.** Louis Dodge. *Machine Design,* v. 17, Feb. '45, pp. 157-162.
Unifies and augments the current knowledge concerning the theory of centerless grinding. Illustrations and tables. 8 ref.

20-61. **Crushed Wheel Dressing in Form Grinding.** Richard Y. Moss. *Iron Age,* v. 155, Feb. 15, '45, pp. 56-59.
Production and laboratory tests indicate that a crusher dressed grinding wheel has faster and cooler cutting action and longer life per dressing than a diamond dressed wheel. The time required to dress the wheel is greatly reduced on intricate profiles, due to the simplicity of the operation.

20-62. **Equipment Can Do Twice as Much.** H. C. Geppinger. *Iron Age,* v. 155, Feb. 15, '45, pp. 64-65.
A typical case of not having enough machines to meet production schedules on the machining of a badly needed airplane manifold is cited as one example of how to make possible the delivery of the right part in the right place at the right time.

20-63. **Improved Method of Precision Boring.** C. R. Phiffer. *Iron Age,* v. 155, Feb. 15, '45, p. 75.
Machining two close tolerance holes in bronze bushings in aluminum gear assembly supports, produces approximately 125 pieces per hr.

20-64. **Negative-Rake Milling.** J. Q. Holmes and R. C. Holloway. *Aircraft Engineering,* v. 17, Jan. '45, pp. 27-28.
Work has been confined to tough 4140 chromium-molybdenum steel forgings; besides stepping up the rate of cutting, a greatly superior finish is secured and close limits, held only with difficulty before, are readily held now. Many more forgings are machined per grind, hence down time is decreased. In no case is more than one cut required, the depth ranging from 1/8 to 1/2 in. Some surfaces which had to be ground after milling with prior practice are now finished in a single cut. (Reprinted from the April, 1944, issue of *Wings.*)

20-65. **Automatic Milling of Side Teeth on Side and Face Cutters.** W. Zikel. *Machinery* (London), v. 66, Jan. 11, '45, pp. 37-40.
Automatic electro-pneumatic milling fixture increases output and quality. One operator can attend to several such fixtures at the same time. The electrical arrangement; the design; two fixtures used.

20-66. **Drum-Type Fixture Speeds up Drilling.** C. R. P. *Machinery* (London), v. 66, Jan. 11, '45, p. 35.

Twenty pieces per minute, as compared with four by the old method, are produced on a drum-type fixture devised for drilling large quantities of small aluminum supports at the U. S. General Electric Co.'s Schenectady Works.

20-67. **Methods Used in Producing Engines for the Super-Fortresses.** K. E. S. *Machinery* (London), v. 66, Jan. 11, '45, pp. 41-44.

New plant built specifically for producing these powerful engines and for machining the crank cases of Cyclone-9 engines.

20-68. **Band Sawing Stainless Steel Shells.** Jack L. McGraw and Aaron H. Shum. *Modern Industrial Press,* v. 7, Feb. '45, pp. 27-28.

The problem of speedily and accurately trimming a tough, triple-drawn, double-walled, 16-gage stainless steel ball joint and its interlocking socket and clamp was superbly solved by a revolutionary motorized saw fixture designed and built at Lockheed Aircraft Corp.'s Plant A-2 for a Yates-American 30-in. wheel band saw.

20-69. **The Use of Carbides for Press Work.** *Tool & Die Journal,* v. 10, Feb. '45, pp. 97-100, 140.

To illustrate design and application practice followed by industry in adapting carbides to press work, a number of commercial applications have been selected. The performance in each individual case has been investigated and the information is presented.

20-70. **Application of Compressed Air Speeds National Acme Production and Cuts Costs.** *Tool & Die Journal,* v. 10, Feb. '45, pp. 104-106, 140.

Liberal application to everyday jobs.

20-71. **Machining "Bristol" Hercules Connecting Rods.** *Machinery* (London), v. 66, Feb. 1, '45, pp. 109-114.

Rods machined from drop forgings of air-hardening nickel-chromium steel, the tensile strength of which, after hardening, is not less than 100 tons per sq. in. Operations commence with broaching the end bosses of the forging to rough width, to provide datum faces.

20-72. **Cam-Profiling Fixture.** J. M. *Machinery* (London) v. 66, Feb. 1, '45, pp. 123-124.

Purpose of this fixture is for milling the profile of face cams, using a standard universal milling machine.

20-73. **Special Twisting Fixture Straightens B-29 Spar Chords.** Harry L. Giwosky. *American Machinist,* v. 89, March 15, '45, pp. 116-118.

Boeing engineers developed the special device for attachment to a standard press. Different blocks are used in straightening chords before and after milling.

20-74. **Clearance and Relief Angles Play a Part in Cutter Performance.** M. Martellotti. *American Machinist,* v. 89, March 15, '45, pp. 119-122.

Number of teeth and proper chip clearance may be

found from the material cut and the nature of the milling operation.

20-75. Practical Ideas. *American Machinist,* v. 89, March 15, '45, pp. 123-128.

Modified chuck insures accurate centers on propeller shafts. Wear reduced by a self-adjusting trolley shoe. Lifting rack expedites handling of heavy hydraulic press dies. Slip-on turnbuckle tightener helps in cramped spaces. Shop truck with overarm transports rings without damage. V-Block reduces time of cutting keyways in round stock. Portable grinding device resurfaces hoist drums in place. Pin router attachment gages and controls depth of cuts. Fixture for straightening bent or twisted band-saws. Burrs on screwheads removed by modified screw-driver. Boring bars interchanged without disturbing the toolholder. Tool for setting small studs works in close quarters. Spring collet used in die to hold down pierced slugs. Electric heater softens plastic tubing. Pipe bending indicator eliminates cut and try methods.

20-76. Tooling Instrument Work for Factory Production.

Panoramic sight, its construction and use; machining, assembly and testing methods used in optical instrument manufacture; tools used in the manufacture of the panoramic sight.

20-77. From Gadget to Stratoliner. W. Hart Nichols. *Tool Engineer,* v. 14, Feb. '45, pp. 41, 54.

Development of a pantograph-type profiling machine for making accurate model airfoils for wind-tunnel tests.

20-78. The Common Sense of Tooling. Charles Marvin. *Tool Engineer,* v. 14, Feb. '45, pp. 42-43.

Tools must be fool-proof; pooled ideas—better tools; ever-changing tool program; plan for constant improvement.

20-79. Bench Drill Press Spindles Driven Through Universal Joints. Harry L. Giwosky. *American Machinist,* v. 89, March 1, '45, pp. 115-116.

Vertical motor supplies power for two-spindle unit. Records show that less maintenance is required than on gear types.

20-80. Practical Ideas. *American Machinist,* v. 89, March 1, '45, pp. 119-124.

Indexing milling fixture takes standard collets. Simplified toolholders reduce set-up and tooling time. Fixture for expediting machining of small parts on a lathe. Tubing straightened in a jig without flattening or nicking. Guide control provides time-saving adjustment for a power brake. Track-mounted portable grinder for finishing long castings. Automatic feed cuts in half time for hardness testing. Bushing plate with indexing drill speeds drilling of bolt circles. Jig automatically determines correct alignment of shafting. Vernier for a machinist's steel scale simplifies measuring.

Painting inside of open-ended cylindrical products. Cutting-off toolholder useful in small shop production.

20-81. **A Study of Some Fundamentals When Face-Milling Steel with Carbides.** Fred W. Lucht. *Mechanical Engineering,* v. 67, March '45, pp. 185-189.

Report on the progress of the investigation on radial rakes to date. This study is still in progress because it is thought that the use of the proper radial rakes on a cutter, the correct method of maintaining them, and the correct method of positioning them in relation to the point where the tooth enters the work, all have a direct bearing on the success or failure of a steel-milling operation.

20-82. **Machining Magnesium.** A. M. Lennie. *Aluminum & Magnesium,* v. 1, Feb. '45, pp. 17-21, 30-31.

Carbide tool recommended; fire hazard not serious; magnesium pieces difficult to ignite; recommended extinguisher; fire precaution necessary; fire record low; causes of warpage; how to control temperature; to eliminate drilling difficulties; reaming problem solved; good machinability of magnesium alloys.

20-83. **Machinability of Copper Alloys.** D. K. Crampton. *Metal Industry,* v. 66, March 9, '45, pp. 150-152.

Shows how machinability is related to the nature of the dispersed phase, the composition, the previous cold work and the nature of the cutting operation. (From *Metal Progress.*)

20-84. **Further Tests Reported on Carbide Hobs.** *Iron Age,* v. 155, March 15, '45, pp. 55-57.

As a result of a new series of operational tests conducted at the Joshua Hendy Iron Works with a composite hob fitted with cemented carbide strip teeth, 80% saving in the time of cutting big marine gears may be expected. Carbide tipped hobs may be operated safely at speeds up to 300 ft. per min.

20-85. **Power Feed Aids Contour Shaping.** *Iron Age,* v. 155, March 15, '45, p. 65.

An increase in production of better than 500% on trimming irregular edges of aircraft parts through an adaptation of a standard woodworking shaper, equipped with a power feed.

20-86. **Production Tooling for Forming, Welding and Machining.** E. Almdale. *Production Engineering & Management,* v. 15, March '45, pp. 65-70.

Line production methods are employed by Midland Steel Products Co. to manufacture Navy ammunition cases and gun mounts. Similarity of methods used to work different materials to meet dissimilar design requirements indicates wide range of possibilities for smart tooling job.

20-87. **Revolving Broach Heads.** David A. Swanson. *Production Engineering & Management,* v. 15, March '45, pp. 71-72.

First operation broaching on screw machine can reduce non-productive handling time when applied to relatively soft materials or light cuts.

20-88. **The "Tooling Ways."** Thomas A. Dickinson. *Production Engineering & Management,* v. 15, March '45, pp. 73-76.

Completely coordinated locations in three dimensions are rapidly established on new device. An offspring of Consolidated Vultee's tooling dock, the "Tooling Ways" is economical in original cost and application.

20-89. **New Machines and Tools Speed Production 200%.** *Production Engineering & Management,* v. 15, March '45, pp. 78-86.

Modern equipment and ingenious fixture design provide production advantage of two-to-one, slash man-hour requirement from 14 to 8.

20-90. **Tap Grinding on Production.** J. Dauber and A. Gabriel. *Production Engineering & Management,* v. 15, March '45, pp. 87-88.

Specially designed equipment permits indexing rough threaded taps and clamping turning dog before placing taps in grinder. Pilot tap setup in grinder is referred to projector used in further setups.

20-91. **Milling Flats on Round Parts.** *Production Engineering & Management,* v. 15, March '45, p. 99.

Inexpensive high production fixture, developed for milling wrench flats on ordnance parts, is applicable to variety of similar jobs.

20-92. **80-Ton Martin Mars Tooled for Production.** C. W. Shipley. *Production Engineering & Management,* v. 15, March '45, pp. 101-104.

Economical tooling for limited aircraft production. Details provide contrast to high production tooling costs which are amortized over thousands of units.

20-93. **Diamond Abrasive Wheels Sharpen the Teeth of Industry.** Willard N. Pratt. *Western Metals,* v. 3, Feb. '45, pp. 24, 27.

Extreme hardness; temperatures.

20-94. **Favored Practice in Machining Zinc Alloy Die Castings, III.** *Die Casting,* v. 3, March '45, pp. 64, 66, 71.

Recommended methods for machining zinc alloy die castings and a discussion of facing and turning procedures.

20-95. **Modified Drill Design Increases Tool Life and Production Rate.** Roy W. Parkinson. *Machinery,* v. 51, March '45, pp. 156-161.

Modified design of spade drill was found to provide increased production speed and longer life between grinds.

20-96. **The Machining of Magnesium Castings.** *Machinery,* v. 51, March '45, pp. 169-171.

Many points to be considered wherein the practice differs from that used for other metals.

20-97. **Selecting the Correct Speeds and Feeds for Cylindrical Grinding.** S. S. Shoemaker. *Machinery,* v. 51, March '45, pp. 184-185.

Rotational speeds of wheel and work.

20-98. **Man-Au-Trol—A New Automatic Machine Tool Control.** *Machinery,* v. 51, March '45, p. 194.

Device provides a new system of control which is said to manage all functions of a machine better than the human mind and experienced hands can do. It embodies a completely automatic control of machines to which it is applied; yet it is an independent unit that is not actually built into the machine.

20-99. **Crush Dressing of Grinding Wheels.** Carl J. Linxweiler. *Steel,* v. 116, March 26, '45, pp. 96-98.

Method of profiling grinding wheels through the use of roller formers has developed beyond the laboratory stage and now emerges as a valuable production technique.

20-100. **Operations in the Production of the "Bristol" Hercules Engine.** *Machinery* (London), v. 66, Feb. 8, '45, pp. 137-140.

Thread rolling and gear shop methods.

20-101. **Securing Fine Surfaces.** H. J. Wills and H. J. Ingram. *Machinery* (London), v. 66, Feb. 15, '45, pp. 181-182.

Production lapping of ground internal and external cylindrical surfaces.

20-102. **Machining Steel Parts on Automatic Screw Machines.** *Machinery* (London), v. 66, Feb. 15, '45, p. 183.

Speed of cutting; power; avoidance of unsupported overhang; coolants.

20-103. **Centerless Grinding of Screw Threads.** Morris Gjesdahl. *Iron Age,* v. 155, March 29, '45, pp. 52-55, 106, 108.

Small headless socket screws are being ground on a production basis at a rate of 60 to 70 per min. on the first centerless type grinder developed for thread work. Design and operating principles of this revolutionary type of machine, which employs a crushed rib wheel, are described.

20-104. **Proper Sharpening Preserves Cutter Life.** M. Martellotti. *American Machinist,* v. 89, March 29, '45, pp. 98-100.

Milling cutters are expensive tools and should be handled with care in order to get efficient cutting action.

20-105. **Recommended Grinding Practice for Round and Concentric Holes.** Stuart St. John. *American Machinist,* v. 89, March 29, '45, pp. 102-104.

Inability to meet requirements for close tolerance is often traceable to simple mistakes. Method of holding the part, the sequence of operations and the balance of the part and holding device important.

20-106. **Practical Ideas.** *American Machinist,* v. 89, March 29, '45, pp. 119-124.

Radio plugs precision-soldered on semi-automatic machine. Top and side chipbreakers ground at same set-up. Accurate drilling obtained by grinding chuck jaws in machine. Deformed welding tips reshaped by

simple swaging die. Four-station lathe carriage stop with an indexing pin. Bevel gear backlash determined by micrometer indicating gages. Special star gage for bomb-bay door screw. Additional life for cup-shaped grinding wheels. Flame cutting free-flowing curves by use of a flexible track. Large tubes cut uniformly by rotary-burning torch. Outboard bearing provides an arbor support for milling unit.

20-107. **Centerless Thread Grinding.** *Steel*, v. 116, April 2, '45, pp. 102-104, 134, 136, 138, 140, 142, 144.

Method is developed for applying centerless grinding principles in producing screw threads on hardened steel blanks at high speed. Half-inch screws ¼ in. in diameter threaded at rate of 85 per min.

20-108. **The Proper Care and Selection of Industrial Diamonds.** Sheldon M. Booth. *Tool & Die Journal*, v. 10, March '45, pp. 106-108.

Importance of careful selective buying of these diamonds for specific uses. Type of setting in which the diamond is mounted and the nature of the tool in which it is to be used. Best methods of wheel dressing with diamond tools in order to prolong the life of the diamond.

20-109. **Landis Centerless Thread Grinder.** *Modern Machine Shop*, v. 17, April '45, pp. 184-186, 188, 190, 192, 194, 196, 198, 200.

Presenting a new development in the field of screw threads, by means of which a thread is generated from the solid in a continuous operation.

20-110. **Selecting Carbides for Milling.** Fred W. Lucht. *Railway Mechanical Engineer*, v. 119, April, '45, pp. 165-166.

Grinding and cutter design are important; feeds and speeds; the selection of grades; the milling of steel, cast and malleable irons; non-ferrous alloys.

20-111. **Ball-Bearing Spindles for Precision Applications.** W. Boneham. *Machinery* (London), v. 66, Feb. 22, '45, pp. 201-204.

Advantages of the ball-bearing spindle compared with the plain bearing type.

20-112. **Grinding Accurate Cam Surfaces.** P. S. *Machinery* (London), v. 66, Feb. 22, '45, pp. 205-208.

Points to be considered in grinding cams, eccentrics and elliptical or relieved pistons.

20-113. **Form Grinding.** *Automobile Engineer*, v. 35, March '45, pp. 111-113.

Advantages in the use of crusher-dressed abrasive wheels.

20-114. **Milling Heavy Aluminum Alloy Forgings and Turnings.** Thomas E. Piper. *Aluminum and Magnesium*, v. 1, March '45, pp. 18-19, 30.

Recent development of new, light and high strength aluminum alloys and the application of highly heat treated steel alloys for aircraft has presented the industry with many machining problems as well as the

grinding problem noted. Tool and cutter designs will vary for every application depending upon the material and its condition.

20-115. **Centerless Grinding of Screw Threads—a Revolutionary Development.** *Machinery,* v. 51, April '45, pp. 188-195.

When centerless grinding of plain cylindrical surfaces was first introduced, the process was looked upon as revolutionary in shop practice—now screw threads are being ground commercially by the centerless method on equipment developed by the Landis Tool Co.

20-116. **Selecting the Correct Speeds and Feeds for Cylindrical Grinding.** S. S. Shoemaker. *Machinery,* v. 51, April '45, pp. 210-211.

Determining traverse and in-feed of wheel. Good surface quality requires reduced traverse; depth of cut, or infeed. The grinding of cast iron.

20-117. **Centerless Grinding of Screw Threads.** James R. Custer. *Automotive Industries,* v. 92, April 1, '45, pp. 23, 108, 110, 112.

In its present state of development, centerless grinding is being applied in production to thread in one pass hardened socket set screw blanks in sizes from 0.112 in., 40 pitch (No. 4) to ⅝ in., 11 pitch. Using an automatic loader, the hourly rate can be increased to 5200.

20-118. **Flexible Tooling for Production Economy.** Frank M. Scotten. *Production Engineering and Management,* v. 15, April '45, pp. 70-73.

Tooling for tire manufacture, from first machining of rough casting to finishing, demands cooperation between shop and engineering. Goodyear controls and methods, which satisfy broad production requirements, include grinding forming tools from designer's templates.

20-119. **Shop Kinks Aid Navy.** *Production Engineering and Management,* v. 15, April '45, pp. 74-76.

Adjustable carriage for portable grinder; adapter for inside micrometer; burring machine saves $9000; instrument to read angles in balancing operations.

20-120. **Production Tools Boost Output and Assure Quality.** *Production Engineering and Management,* v. 15, April '45, pp. 79-83.

In 33 sec., a two-spindle machine with an eight-station rotary table fixture finish mills a die-cast part to plus or minus 0.002 in. Ingenious tooling saves 50%.

20-121. **Holder for Broaching on Screw Machines.** *Production Engineering and Management,* v. 15, April '45, pp. 89-90.

Shows a type of broach holder for use in turrets of either automatic or hand screw machines.

20-122. **Boring Mills Geared for Higher Output.** *Production Engineering and Management,* v. 15, April '45, p. 91.

Increase in top machining speeds with scrap loss on all eight machines.

20-123. **Centerless Method Applied to Production Thread Grinding.** Jerome S. Wilford. *Production Engineering and Management,* v. 15, April '45, pp. 116-117, 198, 200, 202-203.

High production machine, employing formed multi-grooved wheel, is announced as capable of increasing output as much as 500%. Wide range of screw sizes can be processed after heat treatment.

20-124. **Controlled Finish on Journals Can be Produced Economically.** H. S. Indge. *American Machinist,* v. 89, April 12, '45, pp. 107-111.

Mechanical lapping with coated abrasive strip is a fast means of refining ground journals to surface analyzer readings of two to three micro-inches RMS, and do so on a consistent basis.

20-125. **Pneumatic Clamps Speed Slotting of Aircraft Wing Hinges.** *American Machinist,* v. 89, April 12, '45, pp. 122-123.

Substantial savings in set-up time have been realized through replacement of manual holding fixtures by air-operated types.

20-126. **Methods of Sharpening Peripheral and Formed Profile Milling Cutters.** M. Martellotti. *American Machinist,* v. 89, April 12, '45, pp. 124-128.

Practical pointers on the use of several types of abrasive wheels.

20-127. **Practical Ideas.** *American Machinist,* v. 89, April 12, '45, pp. 129-132.

Combined reamer and tap adjusted by three-step tapered mandrel. Drilling jig for holding steel switch boxes. Thread chasers ground uniformly by clamping in fixture. Aircraft turnbuckle wrench proves a time saver. Air-cooled mandrel promotes accurate production. Aluminum structural shapes joggled with inexpensive tools. Special wrench simplifies removal of landing-gear nut. Copper pipe quickly flanged without requiring machinery. Portable pipe flange refacer saves dismantling equipment.

20-128. **Turning and Milling With Negative-Rake Tools.** *Machinery* (London), v. 66, March 8, '45, pp. 249-253.

Advantages of negative rake; turning tests.

20-129. **Air-Operated Milling Fixtures for Locating and Clamping.** *Machinery* (London), v. 66, March 8, '45, pp. 259-261.

Advantages of air-operated clamps, compared with manually operated clamping devices.

20-130. **Influence of Wheel Balance in Fine Grinding.** H. J. Wills and H. J. Ingram. *Machinery* (London), v. 66, March 8, '45, pp. 263-265.

Causes of the appearance of chatter marks on cylindrical work. Methods and equipment employed to balance wheels; arbors equipped with balancing weights.

20-131. **Shaved Aircraft Engine Gears.** Charles G. Pfeffer. *Iron Age,* v. 155, April 12, '45, pp. 54-60.

Any gear that can be ground can be shaved, whether it is free quenched or die quenched. Many such gears are now being shaved in production. Shaving is also being done in production on cluster and internal gears which, because of their shape, could not be ground. Altogether, 60 types of gears are being shaved.

20-132. **Metal and Plaster Mock Up of Fighter Plane Makes Possible Accurate Checks for Forming Tools.** *Steel*, v. 116, April 16, '45, pp. 122, 124.

Tooling for mass production takes less time and expense is reduced by use of full-scale model with framework of wood, steel and dural template stock. Better patterns for cast tools provided by permanent, dimensionally stable model.

20-133. **Machining Heavy Duty Gears.** W. P. Schmitter. *Steel*, v. 116, April 16, '45, pp. 127-128, 164, 166, 168, 172, 174.

War requires making special gears on mass production basis. Some of the special machining and production methods successfully developed to meet this objective.

20-134. **Machinability of Copper Alloys.** D. K. Crampton. *Metal Industry*, v. 66, March 16, '45, pp. 166-168.

Effect of microstructure and composition. Significance of the lead particles in breaking the chips in free-cutting brass discussed. Effect of sulphur, selenium and tellurium on the machinability of copper-base alloys. (From *Metal Progress*.)

20-135. **Mounting Solid Cemented - Carbide Cutting Blades Mechanically.** W. L. Kennicott. *Mechanical Engineering*, v. 67, April '45, pp. 241-243, 254.

Recent development in cemented-carbide cutting tools is the adoption of solid carbide blades, mechanically held in standard or special tool holders. Advantages of solid cutters over the conventional design: Number of regrinds possible on a small-tipped boring tool is very limited; grinding is simpler as the differential-expansion problem is no longer a factor.

20-136. **Centerless Thread Grinding.** M. S. Gjesdahl. *Machine Tool Blue Book*, v. 41, April '45, pp. 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 198, 200, 202, 204, 206, 208.

Machine grinds accurate smooth threads on hardened steel set screw blanks in a single operation. Rate of production shows a decided increase over that of the present methods of cutting threads on screws.

20-137. **Selecting Carbides for Milling.** *Machine Tool Blue Book*, v. 41, April '45, pp. 230, 232, 234, 236.

Grinding; cutter design; feeds and speeds; vibration and chatter.

20-138. **Milling Airplane Cylinder Head Fins.** *Machine Tool Blue Book*, v. 41, April '45, pp. 276-278.

Special machine for milling the circular, partial and dome fins on forged aluminum airplane heads which handles in two operations the milling of the same number of fins which formerly required four machines.

20-139. **Favored Practice in Machining Zinc Alloy Die Castings, IV.** *Die Castings,* v. 3, April '45, pp. 64, 66, 72, 74.

Skiving; boring.

20-140. **Inspection Paces Production.** *Production Engineering and Management,* v. 15, April '45, pp. 84-85.

Design of special slotting jig increased machining of two 0.031-in. slots, of different depths, from 80 to 1200 parts per day.

20-141. **Choice of Carbide Grades.** *Iron Age,* v. 155, April 26, '45, pp. 68-69.

As part of a program of developing standards for machining various metals with cemented carbide tools the standards department of the Crane Co., Chicago, took the initial step of selecting what their experience taught is the most suitable grade of carbide for each application.

20-142. **Simple Inexpensive Tools Produce Fragmentation Bombs.** *American Machinist,* v. 89, April 26, '45, pp. 110-112.

Automatic chucking machines are equipped with a special tapping spindle and work-holding fixture for operations on the bomb head.

20-143. **Sharpening Face Mills and Form Relieved Milling Cutters.** M. Martellotti. *American Machinist,* v. 89, April 26, '45, pp. 114-117.

Description of sharpening methods with details on the handling of face mills and form relieved cutters.

20-144. **Canadian Plant Avoids Handwork in Making Torpedo Propellers.** Chester S. Ricker. *American Machinist,* v. 89, April 26, '45, pp. 121-126.

Modern profiling equipment was chosen for rough machining the blade contours, but finishing operations are performed upon ingenious machines designed by the company's tool engineers.

20-145. **Rigid and Swivel-Type Fixtures Used in Honing Precision Parts.** W. H. Harris. *American Machinist,* v. 89, April 26, '45, pp. 127-130.

Indexing fixtures and provision for automatic positioning and ejection of workpiece speeds the pace of honing operations.

20-146. **Practical Ideas.** *American Machinist,* v. 89, April 26, '45, pp. 131-136.

Gage permits quick set-up regardless of drill length. Adjusting screw in ram of hydraulic press avoids blocking. Continuous tinning reservoir for soldering iron stand. Bushing screw jack useful for pressing bearings into position. Bench tool strips armor from electric cable. Angle clipping jig for shear increases output and safety. Lathe operations simplified by planer toolholder. Bakelite headed metal studs deburred by tumbling. Pipe-slotting attachment for milling machine. Welder's pipe handwheel is a safe and useful attachment. Expanding tool holds pins for gaging in-

ternal gears. Mechanic's squares refinished to restore calibration visibility.

20-147. **Close Tolerance Groove Tooling.** A. W. Ehlers. *Tool & Die Journal,* v. 11, April '45, pp. 95-97, 112.

Tolerance restrictions of width, depth and taper angle must be met with a single point cutting tool. Summarizes data which may prove useful in attacking specific applications.

20-148. **Selecting Carbides for Milling.** Fred W. Lucht. *Tool & Die Journal,* v. 11, April '45, pp. 98-100, 112, 114.

Grinding; cutter design; setup; feeds and speeds; vibration and chatter grade selection; steel milling; other materials.

20-149. **The Art of Metal Cutting, VI.** *Machine Tool Blue Book,* v. 41, May '45, pp. 135-136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 160, 162.

Discussion of the steps involved in conversion to carbide tooling. Following the procedures recommended will result in a better understanding of the requirements of modern carbide tooling—and the improved performance attainable thereby.

20-150. **Rake Conversion Chart for Single-Point Cutting Tools.** D. F. Galloway. *Machinery* (London), v. 66, April 5, '45, pp. 374-376.

Three systems for the measurement and specification of single-point cutting-tool angles.

20-151. **Machining Brass.** W. Stern. *Metal Industry,* v. 66, March 30, '45, pp. 194-196.

Where appearance is of extreme importance, the use of a diamond tool will speedily justify the extra cost, particularly so, where, for any reason, interrupted cuts have to be made. Examples of the saving which can be made by the judicious use of diamonds for highly finished or very thin work. 7 ref.

20-152. **Designing of "Trouble-Free" Dies, XLVII.** C. W. Hinman. *Modern Industrial Press,* v. 7, April '45, p. 26.

Practical designs for drilling, milling, and tapping tools.

20-153. **Segment Sawing at Lockheed.** Jack L. McGraw. *Modern Industrial Press,* v. 7, April '45, pp. 31-32.

Specialized saws to accurately and rapidly trim contoured aluminum parts. The "pivotal" saw for trimming coordinated engine nose cowl thrust rings has eliminated "tailoring" (hand filing and grinding until segments mate along trim lines) and easily produces perfectly matched sections.

20-154. **Faster and Better Milling.** A. O. Schmidt. *Steel,* v. 116, May 7, '45, pp. 107, 164, 166, 168, 170, 172, 174.

Thermodynamic research. 6 ref.

20-155. **Ship-Propeller Milling with Tracer Control.** H. Earl Morton and G. A. Caldwell. *Westinghouse Engineer,* v. 5, May '45, pp. 72-76.

The machine tool is astoundingly accurate, fast, automatic, repetitive. New type of electrical control gives

to the machine tool a sense of touch by which it can feel the contours of a model and sculpture its exact likeness many times enlarged in metal.

20-156. **Enlarged Center Distance System for Improved Gear Tooth Forms.** Merhyle F. Spotts. *Product Engineering,* v. 16, May '45, pp. 339-343.

Method for designing spur gears which are to be generated with a cutting rack or hob that eliminates undercutting the flanks of pinions having a small number of teeth. Equations are developed for non-standard pitch circles, tooth thicknesses, pressure angles, blank diameters and cutter settings.

20-157. **Casting and Machining Iron Crankshafts.** J. G. Bergdoll. *Metals & Alloys,* v. 21, April '45, pp. 994-999.

An example of cast iron's serviceability as a heavy-duty engineering material is its increasing use for crankshafts. An important factor here is its machinability and general ease and economy of working, graphically demonstrated in a picture story of the casting and machining operations done at York Corp. to produce Meehanite crankshafts.

20-158. **Super High Speed Cutting of Metals.** V. D. Kuznetsov. *Iron Age,* v. 155, May 10, '45, pp. 66-69, 142.

Theoretical considerations confirmed by experimental results indicate that the energy consumed in cutting is primarily made up of work done in plastic and elastic deformation. With increasing speed a metal tends to behave more and more as a brittle material, with plastic deformation and hence energy consumption becoming less and less. Turning tests on steel at 4900 ft. per min. showed little heat was generated. Cast iron and aluminum behaved like brittle materials when milled at high speeds, while carbon steel and copper did not. (From *Vestnik Metallopromyshlennosti,* 1940, no. 7.) 6 ref.

20-159. **Grinding Wheel Selection.** M. Martellotti. *American Machinist,* v. 89, May 10, '45, pp. 106-108.

Grinding wheel designations and recommends the types best for cutter sharpening.

20-160. **Adjustable Magazine Feed Developed for Screw Machines.** Harry L. Giwosky. *American Machinist,* v. 89, May 10, '45, p. 109.

Adjustable for parts of different lengths and different diameters. Magazine feed assembly designed for mounting on a No. 2-G Brown & Sharpe automatic screw machine. The feed block is clamped on the cross-slide of the machine so that the work-pieces are individually transferred from the bottom of the feed chute to the collet chuck in the spindle.

20-161. **Stock Removal by Lapping Proves Feasible for Small Parts.** Norman Gray. *American Machinist,* v. 89, May 10, '45, pp. 110-111.

Corners on the comb teeth of the inner shearing member of the 2-M shaver are formed on a multi-ribbed lapping wheel. The operator places the piece in a loosely mounted holder and guides it so that the

comb slots lip over the ribs on the wheel. Clover No. 2A grinding and lapping compound is applied to the wheel at intervals. Production exceeds 100 pieces per hour.

20-162. **Special Boring and Tapping Machines Finish Seamless Steel Bomb Bodies.** *American Machinist,* v. 89, May 10, '45, pp. 112-114.

Machines powered from a central hydraulic system. Leadscrews insure accurate tapping of bombs at each end.

20-163. **Practical Ideas.** *American Machinist,* v. 89, May 10, '45, pp. 119-124.

Large-radius cams ground by milling-machine attachment. Stud threading diehead used in a drill press. Three-hole locating gage for checking size and position. Rivet spinning attachment for drill press spindles. Air-blown chips from spindle bore collected during cleaning. Tight skin-plate joints made with portable hand former. Engine lathe converted to an accurate cam miller. Slotter toolholder takes interchangeable bits. Bench press slowed for forming operations. Power hacksaw attachment for accurate angular cuts.

20-164. **Small Precision Lathes for High Production.** John E. Hyler, *Production Engineering & Management,* v. 15, May '45, pp. 67-70.

Bench lathes, emphasizing the versatility of these machines which combine high production with accuracy. Quick-chucking devices, taper-turning attachments, and turret operation highlighted in a discussion covering range and capacity of equipment.

20-165. **Engineered Carbide Program Pays Dividends.** *Production Engineering & Management,* v. 15, May '45, pp. 72-76.

Successful machining of aluminum and hard-steel alloys at high speeds demands tool design based upon careful analysis of machines and jobs.

20-166. **Auto Builder Produces 3-Piece Crankshaft.** *Production Engineering & Management,* v. 15, May '45, pp. 77-78.

Grinding front section of crankshaft to precision which will balance with other sections in final assembly.

20-167. **Quantity Production and Checking of Parts Requiring Compound Angles.** Frederick W. Plapp. *Machinery,* v. 51, May '45, pp. 158-165.

Solution of compound-angle problems. Computing, dimensioning, and checking of compound angles during tooling and inspection.

20-168. **Multiple Spindle Heads.** C. A. Hoefer. *Steel,* v. 116, May 14, '45, pp. 106-107, 140, 142.

Permit great increase in production; up to 61 or more holes simultaneously drilled in one operation; multiple station setups increase output still more.

20-169. **Broaching of Machine Gun Barrels.** Edwin Laird Cady. *Metals & Alloys*, v. 21, Feb. '45, pp. 388-391.

Describes the process as used at Springfield, with emphasis on the engineering problems that have already been solved and especially on those whose solution, yet to come, will be followed by a remarkable expansion in use of broaching.

20-170. **Bell Aircraft Uses Turret-Head Press for Many Punching and Cutting Operations.** *Steel*, v. 116, April 23, '45, p. 100.

Wiedemann power driven turret punch press which carries 17 punches and dies on the rotating head making it possible to punch different-sized holes on same piece of stock without inserting new die.

20-171. **Machining, Finishing and Testing Die Castings.** H. E. Nagle. *Steel*, v. 116, April 30, '45, pp. 94-96, 98, 100.

Tooling setups; methods for applying organic finishes and testing castings for quality.

20-172. **Hobbing Operation.** Carlton A. Sheffield. *Steel*, v. 116, April 30, '45, pp. 104, 107-108.

Accomplished at high speed on modified machine, using flywheel and composite cutter equipped with tungsten carbide strip teeth.

20-173. **Modern Machine Tools.** *Aircraft Production*, v. 7, March '45, pp. 142-143.

Centerless grinding; profile milling; cam-cutting.

20-174. **Care of Carbide Tipped Milling Cutters.** *Production and Engineering Bulletin*, v. 4, April '45, pp. 140-142.

Hints for storage, handling and maintenance.

20-175. **Precision Grinding.** *Automotive Engineer*, v. 35, April '45, pp. 152-154.

Internal grinder with equipment for finishing external diameters and faces.

20-176. **Wartime Milling at Climax.** *Mining World*, v. 7, May '45, pp. 15-19.

Experience with coarse grinding and new reagents during the war period has resulted in improved metallurgy at Climax.

20-177. **High-production Broaching.** *Machinery* (London), v. 66, April 12, '45, pp. 389-393.

Number of unusual examples of broaching machine applications illustrated and described.

20-178. **General-Purpose Drilling Jig for Small Levers.** C. H. *Machinery* (London), v. 66, April 12, '45, p. 393.

General-purpose fixture suitable for drilling taper-pin, set-screw or pinch-bolt holes.

20-179. **Unusual Operations on Duplex Slot-Milling Machines.** H.H.P. *Machinery* (London), v. 66, April 12, '45, pp. 395-387.

Duplex slot-milling machine can readily be adapted, with exceedingly accurate results, for turning and boring a wide variety of components.

20-180. **Speeding-up Hand Drilling.** *Machinery* (London), v. 66, April 12, '45, pp. 398-399.
Simple attachments give increased output and reduce fatigue.

20-181. **Jig for Drilling Sheet-Metal Components.** D. D. Morgan. *Machinery* (London), v. 66, April 12, '45, p. 402.
Drill jig designed for drilling, on five sides, component fabricated from 1/32-in. thick sheet steel.

20-182. **A Master Assembly-Fixture Tooling Dock.** Harry Wilkin Perry. *Aircraft Engineering,* v. 17, April '45, pp. 118-121.
Mechanical means for positioning the locators on assembly fixtures in strict accordance with loft and under the dimensional control of templates derived therefrom. And it provides physical means for projecting flat master layouts into the third dimension without loss of accuracy.

20-183. **The Importance of Attention to Jig Details.** H. Moore. *Aircraft Engineering,* v. 17, April '45, p. 122.
Points out that proper attention to details is not only desirable but imperative if the fullest possible advantage is to be gained from their use. The perfect drill jig is the one that can be operated with the least amount of effort and the fewest number of movements. Adoption of any of the ideas described will contribute helpfully towards making jig work easier and more profitable than it has ever been before.

20-184. **Milling of Enamels.** A. Biddulph. *Foundry Trade Journal,* v. 75, April '45, pp. 343-345.
Milling of frit is a combination of impact and attrition.

20-185. **High Speeds With Carbide-Tipped Cutters.** *Edgar Allen News,* v. 23, May '45, pp. 433-434.
Principles briefly explained.

20-186. **The Machining of Steel.** F. C. Lea and W. Medway. *Edgar Allen News,* v. 23, May '45, pp. 435-436.
Coolants; cutting-tool steels and their heat treatment.

20-187. **Unusual Machining Operations.** *Steel,* v. 116, May 21, '45, p. 128.
Required to produce parts for jet propulsion engines.

20-188. **Indexing Fixtures Permit Unusual Turret Lathe Operations.** *American Machinist,* v. 89, May 24, '45, pp. 116-118.
In one set-up 24 cuts are taken on a single piece; in another set-up three pieces are indexed and machined at once.

20-189. **Tool Data for Precision Boring—I and II.** Bruno Holmstrom. *American Machinist,* v. 89, May 24, '45, pp. 137, 139.
Details of set-ups for precision boring.

20-190. **Mechanics of the Metal Cutting Process. I. Orthogonal Cutting and a Type 2 Chip.** M. Eugene Merchant. *Journal of Applied Physics,* v. 16, May '45, pp. 267-275.

Analysis of the chip geometry and the force system found in the case of orthogonal cutting accompanied by a type 2 chip has yielded a collection of useful equations which make possible the study of actual machining operations in terms of basic mechanical quantities. The shearing strain undergone by the metal during the formation, and the velocities of shear and of chip flow are among the geometrical quantities which can can be quantitatively determined. The force relationships permit calculation of such quantities as the various significant force components, stresses, the coefficient of friction between chip and cutting tool, and the work done in shearing the metal and in overcoming friction on the tool face.

20-191. **Step Shafts Made on Contouring Lathe.** Clarence Johnson. *Tool & Die Journal,* v. 11, May '45, pp. 99-102.

Economical method for the manufacture of step shafts using an 18-in. lathe equipped with a Bailey contour control. Cutting operation is automatic.

20-192. **Line Boring Fixture.** Alex S. Arnott. *Tool & Die Journal,* v. 11, May '45, pp. 103-106.

Designed to produce small quantity of castings, to perform the boring operations economically without the use of a boring machine, and to avoid changing the setup of the work until all the line boring operations have been completed.

20-193. **Influence of Applying Cutting Fluids at Different Temperatures When Turning Steel.** O. W. Boston, W. W. Gilbert, and R. E. McKee. American Society of Mechanical Engineers *Transactions,* v. 67, May '45, pp. 217-224.

Results of an investigation to determine the influence on cutting speed, tool life, chip formation, and other pertinent factors, of a cutting fluid applied at each of several different constant temperatures, ranging from 55 to 150° F. A sulphurized mineral oil and an emulsion, consisting of 1 part soluble oil and 20 parts water, were used as cutting fluids.

20-194. **A Thermal-Balance Method and Mechanical Investigation for Evaluating Machinability.** A. O. Schmidt, W. W. Gilbert and O. W. Boston. American Society of Mechanical Engineers *Transactions,* v. 67, May '45, pp. 225-232.

Results of an investigation of a calorimetric process for the determination of drilling forces. Description of the machine used and the tests made prior to the investigation with the calorimetric apparatus. 22 ref.

20-195. **An Analysis of the Milling Process, II—Down Milling.** M. E. Martellotti. American Society of Mechanical Engineers *Transactions,* v. 67, May '45, pp. 233-251.

Down milling compared with up milling on the basis of geometric characteristics such as length of tooth path, radius of curvature, thickness of the undeformed section of the chip, chip formation, character of the milled surface, power required in cutting S.A.E. 1112 steel and cast iron, and intensity of vertical and horizontal components of the cutting force obtaining for various depths of cut. Typical mechanical backlash-eliminating devices for the feeding mechanisms of milling machines to permit downmilling operations described. Results obtained in actual application of down milling together with information on cutter life and production.

20-196. **Helical Taper Reamers Milled with Constant Helix Angle.** Thomas F. Githens. American Society of Mechanical Engineers *Transactions*, v. 67, May '45, pp. 303-308.

Process of milling helical flutes on a taper reamer so that the flute will have a constant helix angle of 45° at every point along the length of the reamer. The problem is solved by the development of a former or master cam cylindrical in shape and bearing upon its lateral surface a helical groove such that, as the cylinder turns on its axis with constant angular velocity, the whole former advances in the direction of its own axis at a controlled but variable speed. The milling cutter is mounted so that its plane forms a constant angle with an element of the taper blank being machined to form the reamer. The advantage of the method described is its adaptability to a quick practical solution either mathematically or by graphical means.

20-197. **Time Allowances for Multiple Spindle Drilling.** *Iron Age*, v. 155, May 31, '45, pp. 50-54.

Operation standards for multiple drilling to assure fixed cost factors, to give productive supervision a method of control in maintaining uniform operating and machining conditions, and to facilitate arrival at proper time allowances in establishing uniform piece work rates.

20-198. **Grinding Corrected Angles on Dovetail Forming Tools.** Charles L. Hall. *Production Engineering and Management*, v. 15, June '45, p. 87.

Simple time-saving formula to establish the correct angle to employ when redressing the grinding wheel. Accuracy when regrinding is assured.

20-199. **Thread Gaging with Cemented Carbides.** *Production Engineering and Management*, v. 15, June '45, pp. 88-89.

Savings of more than 80% below estimated cost, the elimination of a serious burden in the tool room, and an exceptionally long life expectancy are among the advantages claimed for carbide thread gages.

20-200. **Savings Effected by Improved Tip Design.** Joseph F. Allen. *Production Engineering and Management*, v. 15, June '45, p. 99.

Reduced grinding time and better utilization of

carbide are claimed for this method of applying tips to cutters. Negative or positive rakes are possible and use of chip breaker groove is optional.

20-201. **Trouble Shooting Problems in Steel Machining.** J. H. Greenberg. *Metal Progress,* v. 47, June '45, pp. 1115-1119.

Points tabulated in a trouble chart; remedies apply only when all other factors are under control and approximately right. One must not change tools, cutting oil, heat treatment all at once, nor should the metallurgist insist that hardness or microstructure or both is the one criterion of machinability.

20-202. **Grinding in Foundries.** C. A. Carlson. *Foundry,* v. 73, June '45, pp. 95, 250, 252, 254, 256, 258.

Grinding wheel behavior on cast iron. With few exceptions grinding is done with silicon carbide wheels vitrified or resinoid bonded. Essential factors to be considered in choosing grinding wheel specifications.

20-203. **Tooling the Automatic Screw Machine, XIII.** Noel Brindle. *Modern Machine Shop,* v. 18, June '45, pp. 124-132, 134, 136.

Slotting attachment and its use.

20-204. **Ideas From Readers.** *Modern Machine Shop,* v. 18, June '45, pp. 170, 172, 174, 176, 178, 180, 182, 184, 186.

Index collet milling fixture. Swinging clamp fixture. Connecting thin-wall tubing to pipe. "Turning the table" of decimal equivalents.

20-205. **Forging and Machining Track Links for Army Tanks.** Charles O. Herb. *Machinery,* v. 51, June '45, pp. 137-147.

Methods for producing all-steel links for the tracks of tanks.

20-206. **Basic Methods of Thread Grinding.** W. J. Grimm. *Machinery,* v. 51, June '45, pp. 148-153.

Principles in present thread grinding practice with single-edge and multi-edge wheels.

20-207. **Selection of Cutting Fluids.** James R. Chambers. *Machinery,* v. 51, June '45, pp. 154-156.

Characteristics of coolants and cutting fluids generally used in industry, and cutting fluids most suitable for different materials.

20-208. **Reducing Scrap by Precautions Taken Before Starting to Grind.** R. E. Price. *Machinery,* v. 51, June '45, pp. 162-164.

Many grinding difficulties are the result of overlooking some very simple precautions.

20-209. **Precision Boring for Accuracy of Roundness and Concentricity.** Berkeley Williams. *Machinery,* v. 51, June '45, pp. 165-168.

Work performed on a Heald Bore-Matic for obtaining concentricity of machined surfaces.

20-210. **Ingenious Mechanical Movements.** L. Kasper. *Machinery,* v. 51, June '45, pp. 173-174.

Mechanisms selected by experienced machine designers; applicable in the construction of automatic machines and other devices.

20-211. **Securing Diamonds in Wheel-Dressing Tools.** Harry L. Strauss, Jr. *Machinery,* v. 51, June '45, p. 179.

Methods by which the diamonds are secured in tools are brazing, casting, powder metallurgy, and induction heating. Advantages and disadvantages of these methods.

20-212. **"Butterfly" Case.** G. W. Birdsall. *Steel,* v. 116, June 4, '45, pp. 104-106.

Ingenious jigs and fixtures devised to facilitate assembly operations in production of unique bomb containers; springs preloaded before assembly.

20-213. **Lathe Attachments.** Robert Mawson. *Steel,* v. 116, June 4, '45, p. 111.

Transform special machining job into production operation, permitting work formerly requiring highly skilled operators to be handled on simple repetitive basis.

20-214. **Practical Ideas.** *American Machinist,* v. 89, May 24, '45, pp. 119-124.

Master arbor for gear cutter uses interchangeable work holders. Stepped tap rechases mutilated threads. Copper-lined lathe dog holds finished metal parts safely. Damaged screws removed by follow-up screwdriver. Accurate radius filing obtained by laying out gage lines. Universal fixture for bending bar stock to shapes. Leveling bar aids set-up of bored castings on shaper. Motor-driven rotary file support improves workmanship. Accidents prevented by use of transparent guard. Good grip and more force applied with extra handle on large file. Puller for small bearings removes sleeves without damage. Pusher removes small pins without bending shafts. Fixture holds washer and pin square while riveting. Hose fittings crimped by use of hand-operated pliers.

20-215. **Flow Reconditioning of Machine Tools.** *Machinery* (London), v. 66, April 19, '45, pp. 417-423.

Methods used in rebuilding Brown & Sharpe automatics.

20-216. **Machine Equipped to Hob Internal Gears.** L. A. and J. S. *Machinery* (London), v. 66, April 19, '45, p. 431.

Gear-hobber equipped to cut internal involute gears accurately, rapidly, and economically. Fixture has a special geared drive, and is mounted on the swivel head of a 160-in. gear hobbing machine.

20-217. **Automatic Broaching Setup.** G. W. Birdsall. *Steel,* v. 116, May 28, '45, pp. 110-112.

Cuts involute internal teeth to full depth on stack of clutch disks. After loading in fixture, machine automatically moves fixture to cutting position, indexes to make series of nine cuts, and returns for unloading.

20-218. **Favored Practice in Machining Zinc Alloy Die Casting. Part 5.** *Die Casting,* v. 3, May '45, pp. 66, 68, 70.
Broaching and shaving; shaving dies; grinding and polishing.

20-219. **Factors in the Application of Carbide Cutters.** *Machinery* (London), v. 66, May 3, '45, pp. 482-484.
Operating precautions; multiple cutter mounting; cutter location in relation to work; speed; feed; number of teeth and power; flycutting.

20-220. **Carbide Hobs for Cutting Marine Propulsion Gears.** A. J. Kroog and R. W. Righter. American Society of Naval Engineers *Journal,* v. 57, May '45, pp. 268-271.
Purpose is to develop interest of gear manufacturers toward increasing the quantity and improving the quality of marine propulsion gears. Possibilities of high productive hobs.

20-221. **Some Suggestions on the Fabrication of Stainless Steels.** Paul F. Voigt. *Steel Processing,* v. 31, May '45, pp. 294-298.
Machining; milling; drilling; tapping; threading; sawing; shearing; deep drawing; spinning; finishes; grinding; polishing; buffing.

20-222. **Electronic Torque Control Prevents Drill Breakage.** *Machinery* (London), v. 66, May 10, '45, pp. 507-508.
Electronic control that automatically backs out the drill when torque exceeds a given amount. The device can be set to operate on as low as 1% increase in torque load on the drill spindle.

20-223. **Simplified Change Gear Calculations.** A. J. Mantell. *Machinery* (London), v. 66, May 10, '45, pp. 510-511.
Attempt to assist the turner in solving the gearing problems which occur in thread cutting on a center lathe with a self-contained gear box, to a lead or pitch which is not to be found on the index plate usually attached above the gear-box.

20-224. **Carbide-Tipped Milling Cutters.** *Aircraft Production,* v. 7, May '45, pp. 232-233.
Hints for storage, handling and maintenance.

20-225. **Centerless Thread Grinding.** *Aircraft Production,* v. 7, May '45, pp. 234-237.
New Landis development which is claimed to increase quality and reduce production times.

20-226. **Modern Machine Tools.** *Aircraft Production,* v. 7, May '45, pp. 251-253.
Billet turning; crankcase facing; face-milling light alloys; slab milling; keyseating.

20-227. **Negative Rake Machining.** *Aircraft Production,* v. 7, May '45, pp. 254-255.
When used under correct conditions, considerable savings can be effected by the new technique. (From American Society of Mechanical Engineers.)

20-228. **Diamond Cutting Tools.** Paul Grodzinski. *Mechanical Engineering,* v. 67, June '45, pp. 369-379.

Present-day application; fundamentals of diamond as a cutting material; cutting-tool nomenclature; plane of chip flow; selection and orientation of diamond; optimum tool shape; setting of the diamond; angular adjustment of diamond tools. 23 ref.

20-229. **Radial Rake Angles in Face Milling.** J. B. Armitage and A. O. Schmidt. *Mechanical Engineering,* v. 67, June '45, pp. 403-406.

Cutter characteristics; effect of negative radial rake angles on tool life and power consumption at the cutter.

20-230. **Favored Practice in Machining Zinc Alloy Die Casting, VI.** *Die Casting,* v. 3, June '45, pp. 60, 62, 64.

Buffing; burnishing and tumbling.

20-231. **Negative Rake Turning and Boring.** *Machinery* (London), v. 66, May 17, '45, pp. 529-535.

Tools described were designed for a particular operation on a specific product which was to be machined on a certain machine. Success of particular tool angles and radii employed depends a great deal on the machine. Reasons why negative-rake carbide turning and boring tools possess desirable advantages.

20-232. **Preferred Numbers and Machine Tool Speeds.** Geo. Schlesinger. *Machinery* (London), v. 66, May 17, '45, pp. 540-543.

Tables which show the application of preferred numbers to the speeds of machine tools.

20-233. **Machining of Ferrous and Non-Ferrous Materials.** J. W. Donaldson. *Metal Treatment,* v. 12, Spring '45, pp. 3-12.

Machinability can be controlled within certain limits. Discusses the general question, including progress made in the technique of making small percentage additions of particular elements to both ferrous and non-ferrous metals in order to improve machinability. The composition of tool steels is considered in this connection, and the effects of heat treatment on certain alloy steels and aluminum alloys, together with the influence of structure and grain size. Several tables demonstrate what has been done to facilitate machine-shop operations. 15 ref.

20-234. **Improved Milling System Decreases Cutter Inventories and Costs.** Arthur A. Schwartz. *American Machinist,* v. 89, June 7, '45, pp. 99-102.

Interchangeability of elements and basic simplicity are the means of attaining increases in over-all efficiency permitted by the use of this new system.

20-235. **Precision Bevel Gears Cut Quickly.** Ernest Wildhaber. *American Machinist,* v. 89, June 7, '45, pp. 106-109.

Revacycle process produces finely finished teeth eased off at their ends to any desired amount.

20-236. **Friction Sawing Proves Faster in Cutting Parts From Plate.** R. C. Holloway. *American Machinist,* v. 89, June 7, '45, pp. 113-114.

Conversion of a conventional bandsaw to friction sawing was not undertaken as a stunt; if an operation yields only a few pieces per hour, a production-minded executive gets busy.

20-237. **Practical Ideas.** *American Machinist,* v. 89, June 7, '45, pp. 115-120.

Rotating quadrant seam welds inside and outside curves. Three-point contact centers tubes and bars for machining. Bandsaw roller guides increase accuracy and reduce breakage. Exhaust hood on rivet gun makes grip comfortable. Targets establish coordinates for laying out large assemblies. Angles clamp holds sheets for welding sharp corners. Wedge roller ratchet replaces ratchet and pawl feed. Spring-cushioned cases preserve instruments against shock. Carbide inserts improve centerless grinder workrest. Billet chuck makes handling large bars more convenient. Torch tips reconditioned by machining new seats. Circular forming tools machine accurate grooves in pistons.

20-238. **Tooling Ways Locates Points in Space.** *American Machinist,* v. 89, June 7, '45, pp. 122-124.

Operating on the same principle as the master dock, the tooling ways can be used in making small and accurate mock-ups, and for light plane and car structures.

20-239. **Foreign Standards for Metric Threads Vary in Many Details.** John Gaillard. *American Machinist,* v. 89, June 7, '45, pp. 133-136.

Potential makers of goods for export should take into account that thread standards of metric countries are not in agreement upon tolerances, crest clearance and pitch-diameter progression.

20-240. **Surface-Finish Chart for Precision Turning and Boring.** Bruno Holmstrom. *American Machinist,* v. 89, June 7, '45, p. 137.

Employed to predetermine the combination of tool radius and lead that will realize the desired Abbott profilometer reading for non-ferrous metals.

20-241. **Surface-Speed Chart for Precision Boring.** Bruno Holmstrom. *American Machinist,* v. 89, June 7, '45, p. 139.

Proves helpful in connection with selecting the surface speed.

20-242. **How Stainless Steel Is Machined at Roebling's.** *American Machinist,* v. 89, June 7, '45, pp. 175-177.

Correct control brings results in quantity production of aircraft cable fittings; tolerances of 0.0005 in. maintained; importance of power, speed, feed, tool angles, coolants.

20-243. **Setup Charts for Automatic Screw Machines.** John J. Meadows. *Iron Age,* v. 155, June 14, '45, pp. 54-60.

By graphical methods, problems involving speeds and feeds can be solved in a fraction of the time necessary to make the calculations from handbooks. Eleven charts presented for various sizes of Acme-Gridley screw machines.

20-244. **The Art of Metal Cutting.** *Machine Tool Blue Book,* v. 41, June '45, pp. 179-180, 182, 184, 186, 188, 190, 192, 198, 200, 202, 204, 206.
Converting to carbide tooling.

20-245. **Maximum Results from the Borizing Process.** C. G. Nordmark. *Machine Tool Blue Book,* v. 41, June '45, pp. 213-214, 216, 218, 220, 222, 224.
First of a series of articles telling of proved shop methods which obtain the utmost in accuracy and surface finish, on a high production basis, by means of the "fly-cutting" technique.

20-246. **Setup Charts for Automatic Screw Machines.** John J. Meadows. *Iron Age,* v. 155, June 21, '45, pp. 62-66.
Six charts for the graphic solution of problems involving speeds and feeds, tapping and high speed drilling change gear ratios for Conomatic 2⅝-in. screw machines.

20-247. **Progress Report on Carbide Hobs.** Alfred J. Krogg and Richard W. Righter. *Iron Age,* v. 155, June 21, '45, pp. 67-69.
Tests made at the Joshua Hendy Iron Works, Sunnyvale, Cal., on carbide hobs for cutting marine propulsion gear teeth. Data indicate that, with a specially modified hobbing machine, a steel pinion of 285 Brinell hardness can be cut successfully at speeds of around 200 ft. per min. with a 6-in. diameter hob.

20-248. **Lathe Production Increased by Multiple-Operation Tooling.** H. E. Shepard. *American Machinist,* v. 89, June 21, '45, pp. 98-101.
Faced with the need for greater machining output, tool engineers adapted a standard engine lathe so semi-automatic chucking could be used.

20-249. **True Circular-Arc Tooth Profiles Provide Accurate Gears.** Ernest Wildhaber. *American Machinist,* v. 89, June 21, '45, pp. 102-104.
Freedom from undercut, a gradual tooth engagement and simple layout result from circular-arc profiles.

20-250. **Carbide-Tipped Cutters Work Well With Heavy Cuts on Cast Steel.** *American Machinist,* v. 89, June 21, '45, pp. 108-109.
Good operators and careful tool grinding contribute to success in introducing negative-rake cutters for use on soft steel.

20-251. **Reamer Eliminates Honing—Discussion.** R. A. Schultz. *American Machinist,* v. 89, June 21, '45, p. 112.
Old end-mill ground to a diameter of 0.500, and with a short lead of about 1/16 in. at 30° and well backed off. Used to ream different materials, it pro-

duced really high finish, polished or, more accurately, planished hole.

20-252. **Practical Ideas.** *American Machinist,* v. 89, June 21, '45, pp. 123-128.

Knife-edge shock absorber installed on balancing stand. Broken hacksaw blades make excellent parting tools. Power hammer stopped by brake at top of stroke. Leaks exposed, pipes cleaned by hot water from circulator. Sealed bearings regreased by simple bench tool. Adjustable portable grinder reduces operator's fatigue. Spherical jointed chocks for machinery foundation. Adjustable hat section joggle die for various section depths. Plate bevels flame-cut with hand-operated protractor. Self-priming discharge line for coolant pumps.

20-253. **Finish Boring of Various Materials, I and II.** Bruno Holmstrom. *American Machinist,* v. 89, June 21, '45, pp 129, 131.

Charts show "starting" shapes on carbide-tipped tools for precision boring at high speeds and light cuts. Modifications must be made if speeds are lowered or stock removal is increased.

20-254. **Consolidated Vultee Tooling Shortcuts.** Thomas A. Dickinson. *Tool & Die Journal,* v. 11, June '45, pp. 101-105.

Dural templates insure accurate centers. Redesign cuts tools and operations to less than one-third. Deformed slugs easily removed from openings.

20-255. **Tooling Ways.** Thomas A. Dickinson. *Steel,* v. 116, June 25, '45, pp. 120-121, 162, 164.

Accurate and efficient substitute for the tooling dock in small scale positioning operations aids in constructing small airplane mockups, jig boring tooling plates, and in setting up panel jigs and fixtures. Adaptable to assembly tooling of light airplanes and automobiles.

20-256. **Setup Charts for Automatic Screw Machines.** John J. Meadows. *Iron Age,* v. 155, June 28, '45, pp. 67-72.

Speed and feed change gear charts and high speed drilling and tapping gear ratios presented for 1⅝-in. 6-spindle New Britain-Gridley screw machines.

20-257. **Cork Blanket for the Hydropress.** *Iron Age,* v. 155, June 28, '45, pp. 73-74, 138.

Hydrocork for hydropress forming of aircraft parts, is offered as a low cost tool material for general sheet metal forming. It performs differently than rubber since there is relatively small lateral expansion when a block of this material is subjected to as much as 50% compression.

20-258. **Safety in the Use of Cold Metal Saws.** *Western Metals,* v. 3, June '45, pp. 49-50, 52.

Hazards of metal saws and precautions to be taken in their use.

20-259. **Vapor Blast Liquid Honing Process.** A. H. Eppler. *Western Metals,* v. 3, June '45, pp. 46-48.

Outline of the development of the vapor blast process and how it works.

20-260. **Chip Control When Machining Steel with Carbides.** Einar Almdale. *Western Metals,* v. 3, June '45, pp. 32-33, 35, 37.

Effect of chip breaker on tool life; chip breaker designs; chip breaker types; controlling chips with rake angles; grinding the breaker.

20-261. **Centerless Grinding.** *Automobile Engineer,* v. 35, May '45, pp. 179-181.

Centerless grinder for producing threaded parts direct from solid blanks. When centerless grinding principles are applied to this class of work, very high production rates can be maintained in conjunction with a high standard of precision.

20-262. **Mechanics of the Metal Cutting Process, II. Plasticity Conditions in Orthogonal Cutting.** M. Eugene Merchant. *Journal of Applied Physics,* v. 16, June '45, pp. 318-324.

Analysis of the mechanics of orthogonal cutting with a type 2 chip extended by introducing those physical properties of the work material which control its plastic behavior. One evident plasticity condition is the equality of the shear stress on the plane of shear to the shear strength of the metal.

20-263. **Burnishing at the Automatic.** *Screw Machine Engineering,* v. 6, June '45, pp. 52-56.

Production of a part on a multiple spindle bar automatic which features burnishing of inside and outside diameters in the 4th spindle position.

20-264. **Economy of Machining Light Metals.** Paul Duboscla rd. *Light Metal Age,* v. 3, June '45, pp. 15, 34.

Recommendations for machining light metals—for feed speeds, for cutter speeds and arrangement of cutter teeth. Comparison is made with steel machining conditions.

20-265. **Seabee Machine Tools.** *Steel,* v. 117, July 2, '45, pp. 102, 154.

Tells how Seabees speed repair of American equipment with makeshift, captured tools.

20-266. **Designing for Milling.** Paul Dutter. *Industrial Aviation,* v. 3, July '45, pp. 47-48, 50.

Basic rules to be considered when designing for the machine shop which will eliminate drawing changes and reduce production time and rejection of parts.

20-267. **Machinability of Cast Magnesium Ingots.** L. R. Jackson and W. W. Beaver. *Industrial Aviation,* v. 3, July '45, pp. 54-55, 97.

Machinability test developed which may be used for investigating the cleanliness of ingots used in making aircraft castings.

20-268. **Radial Rake Angles in Face Milling, II.** J. B. Armitage and A. O. Schmidt. *Mechanical Engineering,* v. 67, July '45, pp. 453-456.

Tool wear, chip formation, and cutting speed in carbide-steel milling.

20-269. **Indicated Principles of Postwar Machining.** Carl Himmelright. *Mechanical Engineering,* v. 67, July '45, pp. 473-474, 479.

Trends in machining practice; designing tooling and fixtures for close-tolerance work; cutting-tool development.

20-270. **Setup Charts for Automatic Screw Machines.** John J. Meadows. *Iron Age,* v. 156, July 5, '45, pp. 63-71.

Charts for the graphical solution of problems involving speeds and feeds on Davenport and Brown & Sharpe automatic screw machines. The charts are particularly useful because the lack of direct relationship of feed per spindle revolution makes a series of approximations necessary, ordinarily involving repeated calculations, which are herein eliminated.

20-271. **Progressive-Die Principle Applied to Production Milling.** E. S. *Machinery* (London), v. 66, May 24, '45, p. 563.

Milling machine equipped with a fixture designed to apply this familiar progressive-die principle to production milling of small parts from bar or rod stock. Bar stock is clamped in the fixture. At every feeding movement of the milling machine table, each of the four cutters removes metal from the bar.

20-272. **Standard Punch and Die Holders.** P. L. Evans. *Machinery* (London), v. 66, May 24, '45, pp. 568-570.

All the standard holders described have given excellent service, effecting a considerable saving in material, machining, tool making and drafting time.

20-273. **Wheel Truing for Fine Grinding.** H. J. Wills and H. J. Ingram. *Machinery* (London), v. 66, May 24, '45, pp. 573-574.

In truing it is preferable to bring the truing tool almost to the highest part of the wheel face and then start the in-feed at 0.001 in. per pass. This will prevent gouging, wheel marks, and damage to the truing tool.

20-274. **Some Facts About Master Gears.** G. H. Sanborn. *American Machinist,* v. 89, July 5, '45, pp. 116-117.

Master gears need not be super-precise if the inspection method is wisely chosen. Gear manufacturers better off if they employ masters in a way that avoids exact overpin dimensions.

20-275. **Compound Sine Plate Simplifies Difficult Positioning Problems.** E. J. Chartier. *American Machinist,* v. 89, July 5, '45, pp. 122-123.

Typical set-ups by machinists often involve setting work at odd angles to working surfaces of machines. An illustration of this difficulty is solved by use of the compound sine plate.

20-276. **Cemented-Carbide Bearings Facilitate Continuous High-Speed Grinding.** James R. Longwell. *American Machinist,* v. 89, July 5, '45, pp. 128-129.

Where conditions of overload, excessive wear and shaft play exist, cemented carbides offer a solution and reduce overhead.

20-277. **Practical Ideas.** *American Machinist,* v. 89, July 5, '45, pp. 135-140.

Blanking dies built up to desired height with steel packing blocks. Fitting edge of plate burnt for Unionmelt welds. Bandsaw miter box permits cutting matched joints. Nut threads finished on small lathe with sizing die. Internal lathe collet stop locates short pieces accurately. Gears in hobbing machine checked with planer gage. Heavy brake forms ends of sheets in one stroke. Set-up table used for checking gang mill assemblies. Piston-ring burrs removed by automatic chamfering machine. Stud extractor removes stubborn studs without breakage. Power driven kick press reduces operator fatigue.

20-278. **Worm Gear Deflection.** Harry Walker. *Automobile Engineer,* v. 35, June '45, pp. 239-244.

Effect of deflection on the performance of the gears is analyzed, and a technique for cutting worm gears to allow for deflection is described. Oversize hob used for cutting the wheels and its lead differs from that of the worm. The method is such that the concentration of load and heavy initial wear normally caused by deflection are avoided and a closer approach to uniform angular velocity transmission is obtained under deflected conditions.

20-279. **Cemented Carbides.** *Automobile Engineer,* v. 35, June '45, pp. 252-253.

American developments in the use of mechanically mounted blades.

20-280. **Developments in Gear Cutting and Finishing Processes.** E. J. Everest. *Machinery* (London), v. 66, May 31, '45, pp. 593-594.

Bevel gears; worm gear; double-helical gears; hobbing process; shaving process; effect of angle between axes; increased rate of cutting by carbides.

20-281. **Milling Forged Cylinder Heads.** *Steel,* v. 117, July 9, '45, pp. 114, 116.

New method features complete automatic cycle after loading through combined hydraulic and electronic control of cutter head.

20-282. **Multiple Tapping of Magnesium and Aluminum.** Charles O. Herb. *Machinery,* v. 51, July '45, pp. 178-183, 202.

How thoughtful consideration of a troublesome problem effected large economies in aircraft engine manufacture.

20-283. **Machining Operations in Building Superfortresses to Bomb Japan.** Earl Delaney. *Machinery,* v. 51, July '45, pp. 192-200.

Typical operations in one of the progressive machine shops of the aircraft industry that have resulted in large production economies.

20-284. **Crankcase Production for the Napier Sabre Engine.** *Machinery* (London), v. 66, June 7, '45, pp. 613-620.

Machining operations on the two castings are almost identical. Some 178 machining operations are employed for each casting; operations described.

20-285. **Tooling for P-38 Production.** Howard Campbell. *Modern Machine Shop,* v. 18, July '45, pp. 124-132, 134.

Concise description of the tools and methods used in the building of the Lockheed "Lightning" P-38.

20-286. **Improved Machining Characteristics of Leaded Steels.** *Modern Machine Shop,* v. 18, July '45, pp. 152, 154, 156, 158, 160, 162, 164, 166, 168.

Review of the characteristics of the leaded steels that have been available in Britain in recent years. Improved machining characteristics of the steels, as compared with non-leaded steels, have led to claims of marked increases in the rate of output of many different products.

20-287. **Ideas from Readers.** *Modern Machine Shop,* v. 18, July '45, pp. 186, 188, 190, 192, 194, 196, 198, 200.

A good tool for contour boring, by A. C. Schmidt. Lathe chuck stand. High production reaming, by R. A. Shaw. Special chuck to machine caps, by Michael Axler. Convair develops precision drill tool. Rack for plug gages.

20-288. **The Art of Metal Cutting, Part VIII.** *Machine Tool Blue Book,* v. 41, July '45, pp. 169-170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190.

Carbide milling of steel.

20-289. **General Tooling-Type and Accuracy Including the Design of Detail Tools and Simple Assembly Fixtures.** B. G. L. Jackman. *Sheet Metal Industries,* v. 21, June '45, pp. 1021-1030, 1036.

General notes on tooling principles.

20-290. **Carbide Techniques at Criterion.** *Western Machinery & Steel World,* v. 36, June '45, pp. 248-249, 263.

From diamonds to precision parts; ability of carbide to cut heat treated steels rapidly makes possible the use of treated forgings and bar stock and eliminates cuts prior to heat treatment.

20-291. **Bevel Mill Speeds Aircraft Production.** *Western Machinery & Steel World,* v. 36, June '45, pp. 258-259, 287.

Cutting of scarfs or bevels on wing skins; purpose of operation is to make a smooth joint which will seal tightly when riveted and permit uninterrupted flow of air over the surface.

20-292. **Selecting Carbides for Milling.** Fred W. Lucht. *Western Machinery & Steel World,* v. 36, June '45, pp. 267, 275.

Steel milling; milling cast and malleable irons; other materials; aluminum alloys.

20-293. **Diamond Cutting Accelerated by an Electric Arc.** Chauncey G. Peters, Karl F. Nefflen, and Forest K.

Harris. National Bureau of Standards *Journal of Research,* v. 34, June '45, pp. 587-593.

By producing a high-voltage electric arc at the contact between the diamond and the lap, cutting rate is materially increased for all orientations of the diamond, and good progress can be made directly on a natural octahedron face, where cutting without the arc is almost impossible. By applying the arc to a diamond saw the sawing rate is greatly increased, and diamonds can be sawed regardless of the orientation of the cut relative to the crystal axes. 5 ref.

20-294. **Tumble-Burring on an Engineering Basis.** Herbert Chase. *Wings,* v. 4, July '45, pp. 1628-1631.

Standardized procedures in improved barrels permit a wide variety of parts to be handled in minimum time, saving thousands of hours of hand-burring. Gears and threaded parts, as well as large and small castings, are successfully treated. Edges are rounded uniformly.

20-295. **High Speed Drilling, Reaming, Tapping.** G. W. Birdsall. *Steel,* v. 117, July 16, '45, pp. 112-115, 154, 156, 159, 160.

Exceptionally efficient hole production methods employ new developments. Semi-automatic setups are individual motor-driven heads equipped with a feeding device centrifugally powered and controlled.

20-296. **Favored Practice in Machining Zinc Alloy Die Casting, Part 7.** *Die Casting,* v. 3, July '45, pp. 61-62, 64-67.

Sawing; spinning; swaging; riveting and staking; gear cutting; filing and burring; punching and shearing; bending and forming; addenda on diamond boring.

20-297. **Design of Machine Tools for Safety and Production.** A. William Meyer. *Product Engineering,* v. 16, July '45, pp. 476-480.

Features that should receive careful consideration in the design of machine tools to provide safety for operators and maintenance men, to prevent overloads caused by improper handling, to reduce manual effort required to manipulate controls, to insure uninterrupted production and to increase the efficiency of operators.

20-298. **Precision Machine Work for Interchangeability Assembly.** Wallace A. Scotten. *Production Engineering and Management,* v. 16, July '45, pp. 67-70.

Rotor job has unusual tool setups on turning operations. Extreme tolerances are maintained on gear finishing, in final assembly, inspection and testing of completed gear trains and boxes.

20-299. **Coated Abrasives Applied to Metal Removal.** I. L. Halstead. *Production Engineering and Management,* v. 16, July '45, pp. 71-73.

New uses for abrasives; coated abrasives excel.

20-300. **Cutting Costs with Better Tooling.** *Production Engineering and Management,* v. 16, July '45, pp. 80-88.

Fixtures with greater versatility and improved ac-

curacy lessened down-time for setups and increased productive capacity of standard machines at General Mills.

20-301. **Increasing the Range of Small Precision Lathes.** John E. Hyler. *Production Engineering and Management,* v. 16, July '45, pp. 89-92.

Typical of the broader application of small lathes to a variety of work, formerly considered to be outside their field of usefulness, are grinding and thread cutting operations. High production performance of these processes has been made possible by the addition of standard accessories. Available accessories are described and the adaptability of the small lathe to competitive manufacturing is suggested by a further outline of its versatility.

20-302. **The Twin Disc Segment Saw.** Jack L. McGraw. *Modern Industrial Press,* v. 7, June '45, pp. 26, 36.

High production warranted the creation of a mechanized, precision sawing machine which would locate and trim the three segments speedily, accurately, economically, and incorporate automatic facility features which would also permit women workers to operate it with minimum handling. Deviation of as much as 0.010 in. from the loft contour while the skin is being trimmed produces mis-matches of some variety. A 1/32-in. constant gap must be maintained between all segments, so the skin must be held exact and the cut must be truly radial all along the width of 16¾ in.

20-303. **Machining Light Alloys.** *Aircraft Production,* v. 7, June '45, p. 265.

Use of high speed flycutters on thin die castings.

20-304. **Modern Machine Tools.** *Aircraft Production,* v. 7, June '45, pp. 284-286.

Rotor turning; worm machining; centerless lapping.

20-305. **High-Speed Milling.** *Aircraft Production,* v. 7, June '45, p. 296.

Hints for firms considering the adoption of carbide-tipped cutters.

20-306. **Maximum Results from the Borizing Process.** C. G. Nordmark. *Machine Tool Blue Book,* v. 41, July '45, pp. 201-202, 204, 206, 208, 210, 212, 214, 216, 218, 220.

Tells which materials can be successfully borized, and how the characteristics of the material affect the type of tool to use, as well as the speeds, leads and depth of cut.

20-307. **Recent Progress in Milling Machine Operations.** C. W. Hinman. *Machine Tool Blue Book,* v. 41, July '45, pp. 245-246, 248, 250, 252, 254, 256.

A few of the major ones discussed.

20-308. **Preventing Cracks in Cemented Carbide Tools.** William Newcomer. *Machine Tool Blue Book,* v. 41, July '45, pp. 281-282, 284.

New method of brazing cemented carbide tips to tool shanks is designed to permit heavier cutting and to increase tool life.

20-309. **Carbide Cutters—Their Application and Selection.** Anders Jansson. *Tool Engineer,* v. 14, June '45, pp. 24-28.

Factors in selecting grades; no vibration or chatter; negative rakes in milling; honing increases tool life; selecting the grades; selection charts.

20-310. **Tracer Controlled Milling.** Andrew E. Rylander. *Tool Engineer,* v. 14, June '45, pp. 30-33.

Modern profilers in both actual size and pantograph types assure speed and accuracy in duplicating irregular work.

20-311. **Broaching Solves Difficult Production Problem.** Joe Dostal. *Tool Engineer,* v. 14, June '45, pp. 34-37.

An achievement in tool engineering, in which quality and high production are attained through unusual applications of usual techniques.

20-312. **The Engineering Approach to Machine Tool Selection.** Edwin Laird Cady. *Metals & Alloys,* v. 21, June, '45, pp. 1620-1625.

Application of engineering principles and control in the processing of their materials and the fabrication of their products. Shows how and why it has affected metal-working's No. 1 production method—machining—and the selection of the equipment. Aids the engineer in meeting these fuller responsibilities through better over-all production planning, better machine tool selection, better machine tool design and better machine tool use and operation.

20-313. **Balanced Linkage Obviates Thrust on Frame.** Paul S. Jackson. *Machine Design,* v. 17, July '45, pp. 117-120.

Importance of firmly anchoring the copper "rotating band" on large caliber Navy shells necessitated the development of special shell-notching machines. Automatic cycling is utilized which indexes for each notching stroke and stops after the entire periphery is notched.

20-314. **Clutches and Couplings Produced Rapidly on Standard Gear Machine.** Ernest Wildhaber. *American Machinist,* v. 89, July 19, '45, pp. 110-112.

Better finish and greater load carrying capacity are imparted to face clutches and couplings by the simultaneous cutting of opposite sides of spaced teeth.

20-315. **Form-Tool Correction Made Easy by a Simple Formula.** Alfred S. Gutman. *American Machinist,* v. 89, July 19, '45, pp. 116-117.

Formula provides immediately the correct angles for form grinding the tool, and it is then a simple matter to calculate tool dimensions. Problem that led up to derivation of the formula given.

20-316. **Practical Ideas.** *American Machinist,* v. 89, July 19, '45, pp. 131-136.

Hat section bends corrected and twists removed by straightener. Boring bar bits held without setscrews. Diamond saw quickly slots binocular prisms. Punch press attachment for spacing holes automatically.

Shutter-speed rings chucked by an arbor gripped in a collet. Van stone flanging—die liner reduces replacement expense. Counterbore toolholder for close tolerance work. Parallel and square grinding of pin ends in fixture. Chain-grip pipe vise with toggle tightener. Jig holds sheet metal to angle while riveting. End bushings soldered into drawn steel shells. Short lift hydraulic jack for close quarters. Helical pipe coils wound on mandrel while heated.

20-317. **Universally Adjustable Turning Tools.** Paul Grodzinski. *Industrial Diamond Review,* v. 5, June '45, pp. 126-129.

Designation of tool angles; designation of adjustment angles; main adjustments; real clearance angle, real rake angle; change in cutting angles when tool edge is rotated about horizontal axis in direction of shank; change in cutting angles when tool edge is rotated about a vertical axis; change in cutting angles when tool edge is rotated about horizontal axis perpendicular to shank direction.

20-318. **Wheel Truing Mechanism for Profile Grinder.** E. A. Cooke. *Industrial Diamond Review,* v. 5, June '45, pp. 132-133.

Wheel truing mechanism which is versatile and accurate, and is capable of producing any wheel shape which consists of straight lines or true radii, or of a combination of these. Position of the truing diamond is located by the graticule of a separate microscope on some models, and by the graticule of a built-in microscope on others.

20-319. **Ship Propeller Milling.** *Steel,* v. 117, July 23, '45, pp. 106-109, 141, 144, 146, 148.

Cooperative action between electrical and mechanical devices on unusual milling machine has much significance. Guarantees swift, accurate generation of any contour on ship propellers. 6 ref.

20-320. **Modified Drill Design.** R. W. P. *Machinery* (London), v. 66, June 28, '45, pp. 697-700.

Tool life and production rate increased.

20-321. **Worm Cutting and Milling.** *Machinery* (London), v. 66, June 28, '45, p. 701.

On the lathe it is only a few minutes' work to take a thousandth or two off the sides or to ease the tops of the threads, but on the comparatively inflexible thread miller it is a very different proposition.

20-322. **Universally Adjustable Turning Tools.** Paul Grodzinski. *Industrial Diamond Review,* v. 5, July '45, pp. 149-152.

Combination of angles; radiused and faceted tool edges; back cutting edge.

20-323. **Compound Tools—How to Use Them.** J. A. Grainger. *Sheet Metal Industries,* v. 22, July '45, pp. 1187-1192, 1194.

Tool shown combines all the operations which are performed by the previous tool, plus an operation

for plunging a flange around the pierced hole. Thus, the tool becomes a blank, pierce, and plunge tool.

20-324. **Fusion Cutting by High Speed Bandsaw.** R. W. Hancock. *Sheet Metal Industries,* v. 22, July '45, pp. 1205-1210.

Standard woodworking bandsaw is speeded up; intense heat is generated by friction when work is fed into this saw, and in the case of sheet metal it is such that the saw is cutting material which will locally be at melting point, or, more accurately, the saw partly cuts and partly brushes away the semi-molten material. Principal advantage of the process is that fast, effortless cutting is achieved with no appreciable work-drag or distortion. This means that a cut can be made in any direction across a contoured pressing and that no snatching or chattering takes place when cutting a weak or unsupported section.

20-325. **Rodney Calculator for Cam Surfaces.** William D. Rodney. *Screw Machine Engineering,* v. 6, July '45, pp. 58-60.

Convenient device to calculate turret indexing and pullouts in drilling operations.

20-326. **Cincinnati Centerless Grinding Machine.** *Screw Machine Engineering,* v. 6, July '45, pp. 70-78.

Elements of the centerless grinder; principles of centerless grinding; centerless grinding methods.

20-327. **End-Forming Toolholder and Tool.** W. Bruce. *Screw Machine Engineering,* v. 6, July '45, p. 81.

York Arsenals development for Acme-Gridley bar automatics.

20-328. **Radial Rake Angles in Face Milling—3.** J. B. Armitage and A. O. Schmidt. *Mechanical Engineering,* v. 67, Aug. '45, pp. 507-510.

Milling cutters with double radial rake angles. Effect of cutting speed on tool life and chip formation of a combined positive and negative radial rake angle cutter. Results were compared with those of a similar investigation on negative radial rake angle cutters.

20-329. **Ultra-Fine Surfaces on Metals.** Kenneth Rose. *Metals & Alloys,* v. 22, July '45, pp. 70-75.

Practices employed to produce ultra-smooth surfaces on metal parts and tools; grinding, lapping, superfinishing; their engineering applications and the methods of evaluating highly smooth metal surfaces.

20-330. **Machine Tool Magic.** Edwin Laird Cady. *Scientific American,* v. 173, Aug. '45, pp. 79-80, 82.

Machines that make other machines have progressed rapidly during the war, yet the immediate future will demand continuing supplies of new tools. What improved machine tools mean to industry and what may be expected of them in the light of new knowledge.

20-331. **Trimming Parts.** *Steel,* v. 117, July 30, '45, p. 94.

Irregular edges of aircraft components finished by adaptation of standard wood shaper.

20-332. **Modern Machine Tools.** *Aircraft Production,* v. 7, July '45, pp. 340-341.
Assembly presses; molding plastics.

20-333. **Final Operations, II.** G. Schlesinger. *Aircraft Production,* v. 7, July '45, pp. 350-354.
Polishing, buffing and burnishing; chipless forming operations; bearings and spindles.

20-334. **An Investigation of Radial Rake Angles in Face Milling, I.** J. B. Armitage and A. O. Schmidt. *Western Metals,* v. 3, July '45, pp. 11-14, 16.
Effect of negative and positive radial rake angles in milling cutters upon the power required for the cutting action, the tool life of the cutter, the surface finish, and temperature of the work-piece. Tests were conducted with 2-in. face mills which had two brazed carbide tips.

20-335. **Hints on Multiple Tool Steel Turning with Carbides on Tomorrow's Machines.** Ralph Granzow. *Western Metals,* v. 3, July '45, pp. 36-37.
Basic principles of cutting tool design.

20-336. **Air-Hydraulic Milling Vise Permits Controlled Clamping Pressure.** Conrad Mattson. *American Machinist,* v. 89, Aug. 2, '45, pp. 104-105.
Four castings are used in the vise developed for high-speed carbide milling of steel and aluminum alloy parts. Jaw openings are regulated easily.

20-337. **Gear-Driven Straight Edge.** *American Machinist,* v. 89, Aug. 2, '45, p. 113.
Made with heavy sections to insure rigidity and when completely assembled weighs between 3200 and 3300 lb. It is 15 ft. long.

20-338. **Production Tooling for Standard Machine Tools.** E. C. Salisbury. *Production Engineering & Management,* v. 16, Aug. '45, pp. 71-75.
Using ingenious fixtures and unusual cutting tools, Curtiss-Wright specifies standard machines on all operations in its big Buffalo machine shops. Benefits claimed are greater flexibility and the ability to handle "red hot" product design changes in production.

20-339. **Grinding Positioned Flats in an Indexing Fixture.** *Production Engineering & Management,* v. 16, Aug. '45, p. 76.
Novel method solves grinding problem presented by stud loaded disk.

20-340. **Mechanical System Solves Chip Disposal.** John T. Smith. *Production Engineering & Management,* v. 16, Aug. '45, pp. 88-91.
Pointing to future trends in plant design, Pontiac's completely mechanical chip and coolant handling equipment reduces manpower requirements, increases over-all plant output.

20-341. **Establishing the Corrected Drop on Forming Tools.** Charles L. Hall. *Production Engineering & Management,* v. 16, Aug. '45, p. 92.

Formula provides the corrections required for checking or grinding a forming tool when held in a horizontal position.

20-342. **Pneumatic Tools Reduce Production Costs.** *Production Engineering & Management,* v. 16, Aug. '45, pp. 93-94.

Efficiency, ease of handling because of their light weight and variety of applications all are contributing factors to the greatly expanding use of air operated tools in metal-working.

20-343. **Profile Milling.** *Steel,* v. 117, Aug. 6, '45. p. 128.

Three consecutive operations on aircraft diffuser part expedite production and reduce to minimum costly hand-finishing operations formerly required.

20-344. **Tooling for P-38 Production, II.** Howard Campbell. *Modern Machine Shop,* v. 18, Aug. '45, pp. 124-128, 130.

Describes tools and methods used in the building of the Lockheed Lightning P-38.

20-345. **High Speed Milling With Carbide Tools.** Fred M. Burt. *Modern Machine Shop,* v. 18, Aug. '45, pp. 134, 136, 138, 140, 142, 144, 146, 148, 150.

Few pointers which should be helpful to users of carbide-tipped milling cutters.

20-346. **Ideas from Readers.** *Modern Machine Shop,* v. 18, Aug. '45, pp. 213-214, 216, 218, 220, 222, 224, 226, 228, 230.

Differential adjusting screw for boring bars. Broaching rectangular taper holes in the shaper. Right angle gage. Multiple height gage.

20-347. **The Art of Metal Cutting. Part IX — Carbide Milling of Steel.** *Machine Tool Blue Book,* v. 41, Aug. '45, pp. 139-140, 142, 144, 146, 148, 150, 152, 154, 156.

Higher surface foot rates; thicker chips; fewer teeth per cutter; increased power consumption; flywheels when practical; no coolant required; diamond grinding wheels.

20-348. **Maximum Results from Borizing. Part 3.** C. G. Nordmark. *Machine Tool Blue Book,* v. 41, Aug. '45, pp. 163-164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184.

Shows by actual examples how the versatility of borizing technique enables great accuracy to be achieved.

20-349. **Speed and Precision with Hyper Drilling.** Karl Stad. *Tool Engineer,* v. 14, July '45, pp. 33-35.

Revolutionary technique portends speeds in mass production drilling far beyond present practices.

20-350. **Spiral Grinding of Tools.** Franklin J. Blaney. *Tool Engineer,* v. 14, July '45, pp. 47-48.

Thread grinding principles used as a basis.

20-351. **Foreign Tool Steel Comparison Chart.** *Iron Age,* v. 156, Aug. 2, '45, pp. 48-50.

Identifies foreign tool steels from the trade name.

20-352. **Bearing Lands and Negative Rakes Prolong Cutting Tool Life.** Mark W. Purser. *American Machinist,* v. 89, Aug. 2, '45, pp. 118-121.

Important progress in solution of wear, chatter and set-up of cutting tools made by lapping slight land just below cutting edge and by stoning a negative rake around this cutting edge.

20-353. **Tooling for Compound-Contoured Parts.** John Thawley. *American Machinist,* v. 89, Aug. 2, '45, pp. 124-125.

Plaster mock-ups are used in making stretch forms for the mass production of all-metal warplanes. Tool fabrication is sped by standardization.

20-354. **Both Sides of Face Clutch Teeth Cut with Single Cutter in One Operation.** Ernest Wildhaber. *American Machinist,* v. 89, Aug. 2, '45, pp. 126-128.

Rapid production of overload and sawtooth clutches on gear cutting machines outlined.

20-355. **Practical Ideas.** *American Machinist,* v. 89, Aug. 2, '45, pp. 129-134.

Brake drums of airplane wheels ground while assembled to hub. Large washers are quickly cut on a burning table. Air cylinder propelled air hammer drives main shaft coupling bolts. Dial indicator on carriage makes micrometer stop gage on lathe. Collet block releases expensive precision machine tools. Adjustable taper gage duplicates dimensions for exact shaft fits. Centering and facing tool for bench lathe production. Gage for small shear eliminates marking of bars. Forming jig holds bar stock in position for welding. Cams replaced on shafts reamed for taper pins. Automatic chuck centers rifle barrels and eliminates dogs. Damaged pneumatic tool cylinders salvaged by honing. Pliers used as drill jig for locating rivet holes. Sandblasting holes avoids expensive die alterations.

20-356. **New Ryan Dimpling Process for Hard Aluminum Alloys.** *Aero Digest,* v. 50, Aug. 1, '45, p. 121.

Advantages reported for the Ryan process over presently available techniques are the time it saves, lowered costs, and the high quality of dimples and riveting work which result.

20-357. **Diamond Dust—A Review of Recent Literature.** *Industrial Diamond Review,* v. 5, Aug. '45, pp. 169-171, 181.

Production methods; diamond dies and diamond tipped tools; machining synthetic sapphire and quartz; grinding sintered carbide tools and dies; preparing the laps.

20-358. **Diamond Hones—A New Development.** F. Whitehead. *Industrial Diamond Review,* v. 5, Aug. '45, pp. 172-174.

Special hones for the simultaneous honing of cylinder sleeves contain six honing sticks each in three self-adjustable jaws. Description of equipment.

20-359. **Facilitating Adjustment of Diamond Tools.** G. Schlesinger and D. F. Galloway. *Industrial Diamond Review,* v. 5, Aug. '45, pp. 180-181.

Adjustment of faceted diamond tools; rake adjustment; height adjustment.

20-360. **Influence of Tool Shape and Cutting Conditions on Surface Quality.** S. P. Semenov. *Industrial Diamond Review,* v. 5, Aug. '45, pp. 183-184.
Equipment; influence of cutting speed; influence of rate of feed; influence of depth of cut; influence of point radius of the tool; influence of tool angles.

20-361. **One Hundred Million Die Castings.** Fred M. Burt. *Tool Engineer,* v. 15, Aug. '45, pp. 18-22.
Outline of tooling and production methods responsible for tremendous war output with maximum quality.

20-362. **Power Requirements in Milling.** A. O. Schmidt. *Tool Engineer,* v. 15, Aug. '45, pp. 23-26.
Calorimetric tests basis of formula for determining horsepower required in carbide steel milling. 4 ref.

20-363. **Cutting Your Costs With the Hack Saw.** Frank T. Wruk. *Tool Engineer,* v. 15, Aug. '45, pp. 42-44.
Recent developments in machines, blades and methods make this process economical and speedy.

20-364. **Tool Design—With Control.** E. A. Cyrol. *Tool Engineer,* v. 15, Aug. '45, p. 48.
Good tool design alone does not bring efficient production. There must also be tool control.

20-365. **Economical Jigs and Fixtures for Short Run Production.** Alex S. Arnott. *Tool & Die Journal,* v. 11, Aug. '45, pp. 104-107.
Turning fixture; milling fixture; first operation drill jig; second operation drill jig.

20-366. **Measurements of Temperatures in Metal Cutting.** A. O. Schmidt, O. W. Boston, and W. W. Gilbert. *Tool & Die Journal,* v. 11, Aug. '45, pp. 115-116, 118, 120.
Chip temperature is uniform at high cutting speeds when other conditions are constant. Temperature of the tool increases with the cutting speed, and the amount of metal removed before tool failure is inversely proportional to the cutting speed. 6 ref.

20-367. **Diamonds as Tools Speed up Victory.** *Domestic Commerce,* v. 33, Aug. '45, pp. 28-29.
An industry must; three types of diamonds; world production down; large use in drills; base-metal use; production costs reduced; varied uses; diamond dies.

20-368. **Out-of-the-Ordinary Internal Grinding Set-Ups.** Carl G. Nordmark. *Machinery,* v. 51, Aug. '45, pp. 152-156.
Some of the set-ups illustrated solve difficult grinding problems; others are designed to secure faster or more accurate production.

20-369. **Recommendations for High Speed Carbide Milling.** *Western Machinery and Steel World,* v. 36, July '45, pp. 306-307, 324, 327.
Recommendations based on research and experience in actual shop production; general rules for choice of speed.

20-370. **Machining Gun-Mounting Bases on Horizontal Boring Machines.** G. I. D. *Machinery* (London), v. 67, July 12, '45, pp. 29-34.

Advantages of horizontal borers; adapting the machines; first operation; special milling cutter.

20-371. **The Unification of Screw Threads.** *Machinery* (London), v. 67, July 12, '45, pp. 48-50.

Thread grinding and thread rolling; tolerances for tropical finish; desirability of a 60° thread.

20-372. **Face Milling.** *Automobile Engineer,* v. 35, July '45, pp. 287-288.

Tests with cemented carbide tools of different radial rake angles.

20-373. **Negative Rake Turning Tools Improve Roughing Cuts in Steel.** Carroll Edgar. *American Machinist,* v. 89, Aug. 16, '45, pp. 99-101.

Carbide-tipped turning tools having negative side and back rake provide longer tool life between grinds. Negative rake finishing, facing and boring.

20-374. **Gear "Rolling".** G. W. Birdsall. Steel, v. 117, Aug. 20, '45, pp. 126-127, 164, 166.

Fast method of checking in gear production becomes increasingly useful with the development of ingenious fixtures.

20-375. **Practical Ideas.** *American Machinist,* v. 89, Aug. 16, '45, pp. 127-132.

Armature pivots polished without removing from the armature. Simple welding operation stops leakage from oil pans. Fishtail mill machines alloy bronze castings quickly. Wheel dressing attachment for external thread grinder. Precision toolholder for turning inside and outside curves. Brass-faced removable liners clamp to vise jaws. Sliding plate gage checks punch nose profile. Micrometer indicator measures counterbore or countersink depth. Light-metal shield directs fumes away from welder. Automatic clamping for quick loading and unloading chuck. Grooves in grinding wheel rim increase active life. Overload safety device for whirler cranes.

20-376. **Jig Grinders Tackle Production Problems.** Frederick C. Victory, *Steel,* v. 117, Aug. 20, '45, pp. 132-133, 176, 178, 180, 182.

Practical, precision machine with a planetary grinding head called the jig grinder has put the final positioning and sizing of holes in hardened work on a true "machine shop practice" basis.

20-377. **Production Work on Jig Borers.** Carl Himmelright. *Iron Age,* v. 156, Aug. 23, '45, pp. 72-73.

When fixture and gage tolerances are encountered on production work, toolroom procedures are adopted to such operations. Set-up jigs on jig borers for the manufacture of gear frames or housings for gun power drive mechanisms.

20-378. **An Investigation of Radial Rake Angles in Face Milling.** J. B. Armitage and A. O. Schmidt. *Western Metals,* v. 3, Aug. '45, pp. 9-13.

Negative radial rake angles were found to produce stronger cutting tips. Power required at the cutting edge is higher for the negative radial rake cutter than for cutters with positive radial rake angles. Cutters with negative radial rake angles will stand up longer at the higher speeds. Wear and failure at high speeds on the cutting edge of a positive radial rake angle cutter will soon increase its power consumption above that of a cutter with negative radial rake angles. Best surface finish in high speed milling is produced with a negative radial rake cutter at cutting speeds between 500 and 800 fpm. 6 ref.

20-379. **Large Radii on Small Machine Tools.** Rudie Regen. *Western Metals,* v. 3, Aug. '45, p. 19.

Simple method of machining precise spherical surfaces at radii greatly in excess of average tool room capacity.

20-380. **Broaching Hardened Involute Splines.** Carl Himmelright. *Iron Age,* v. 156, Aug. 30, '45, page 36P.

Broaching of involute splines in a hardened, bell-shaped hub. After the forging is machined in turret lathes, the bore is broached to form the involute splines in the hub in the soft state.

20-381. **Selection and Use of Diamond Tools.** Edward L. Murray. *Iron Age,* v. 156, Aug. 30, '45, pp. 38-41.

Diamond tools are being used now more than ever before. Applications these tools are best fitted for, the types of tools, and the technique for using them are discussed.

20-382. **Modern Machine Tools.** *Aircraft Production,* v. 7, Aug. '45, pp. 385-387.

Latest additions to the range of factory plant. Injection molding; gear cutting; pre-filling press.

20-383. **Special Feeds Adapt Automatics for Second-Operation Work.** Ben C. Brosheer. *American Machinist,* v. 89, Aug. 30, '45, pp. 106-109.

Pick-off arms and cross-slides are used in transferring work. One operator can supervise as many as eight screw machines.

20-384. **Coolant Improves Carbide Sawing of Steel and Aluminum Alloy Bars.** A. Leonhardt. *American Machinist,* v. 89, Aug. 30, '45, pp. 118-119.

Experimental set-ups indicate that high speed sawing costs may be reduced so they compare favorably with burn-mill costs.

20-385. **Gear Tooth Curvature Treated Simply.** Ernest Wildhaber. *American Machinist,* v. 89, Aug. 30, '45, pp. 122-125.

A continuous use of tooth normal facilitates broader determination of the curvature data which control the load capacity of tooth surfaces.

20-386. **Statistical Control of Assemblies Eliminates Selective Fitting.** Benjamin Epstein. *American Machinist,* v. 89, Aug. 30, '45, pp. 126-127.

Manufacturing engineers often face the problem of relating assembly tolerances and those established for component parts. A method that permits random assembly.

20-387. **Practical Ideas.** *American Machinist,* v. 89, Aug. 30, '45, 131-136.

Quick releasing chuck for holding second operation threaded parts. Chuck attachment simplifies holding of shoulder bolts. Accurate spacing gages for gang milling cutter set-up. Threaded lock-pin replaces taper pin in toolholder. Hydraulic jack presses or pulls welding machine rotors. Router bit collet holds tool concentric and tight. Preheating valve disks before refacing with stellite. Countersinking to constant depth with power-controlled spindle. Three-piece heavy duty bearing bored in a large lathe. Electric drill chucks removed without damaging gears. Rubber stamp locates dimensions for jig boring holes. Joggle die adjustable for various amounts of offset. Locator for correct positioning feeds blank to drawing die. Micrometer depth attachment for pneumatic drills.

20-388. **Machine Tool Industry Faces New Challenges and Opportunities.** Guy Hubbard. *Steel,* v. 117, Sept. 3, '45, pp. 124-126, 184.

Postwar becomes sudden reality, and sweeping conversion to peacetime production begins.

20-389. **Calculation of Dovetail and Flat Forming Tools With Top Rake.** John H. Beck. *Screw Machine Engineering,* v. 6, Aug. '45, pp. 54-62.

Mathematical presentation.

20-390. **Selection and Use of Diamond Tools.** Edward L. Murray. *Iron Age,* v. 156, Sept. 6, '45, pp. 94-96.

Machine tool design for using diamond tools, wheel dressing, diamond abrasives, etc.

20-391. **Precision Milling at High Speed.** William Lawrence Lewis. *Western Machinery & Steel World,* v. 36, Aug. '45, pp. 344-347.

Describes procedures in Adel shops concerned with milling material to the shape and dimensions required by the design of the parts and the tooling to make them.

20-392. **Recommendations for Grinding of Cutters for High Speed Carbide Milling.** *Western Machinery & Steel World,* v. 36, Aug. '45, pp. 362-364, 372-373.

Effective and workable technique that produces all the requirements for successful cutter preparation. These include: A smooth cutting edge, free from defects; a fine surface finish on the carbide; consistent results; economical methods, i. e., rapid production grinding without jeopardizing the first three points.

20-393. **Crankshaft Production for the Napier Sabre Engine.** *Machinery* (London), v. 67, July 19, '45, pp. 57-64.

Two six-throw crankshafts each run in seven lead-bronze bearings of the steel-shell pattern. Each crankshaft at its forward end meshes with a pair of compound reduction gears and the large diameter helical gear of the air-screw shaft, which is on the center line of the engine, midway between the two crankshafts, is engaged by the forward pinions of the four compound gears. The two crankshafts rotate in the same direction. They are machined from drop forgings of nitriding steel the material conforming to D.T.D. specification 228, or alternatively, D.T.D. specification 306.

20-394. **Production Processes. Part III. Automatic Screw Machining.** Roger W. Bolz. *Machine Design,* v. 17, Sept. '45, pp. 135-140.

Design; long slender parts a problem; tolerances; limits sometimes reduce production.

20-395. **Machining Bronze Counterweights for B-29 Crankshafts.** Joseph Geschelin. *Automotive Industries,* v. 93, Sept. 1, '45, pp. 22-24, 94.

Need for positive clamping devices brought about a complete change in tooling and fixture design as well as modified procedures.

20-396. **Chip and Oil Salvage is Profitable.** H. O. Stock. *Modern Machine Shop,* v. 18, Sept. '45, pp. 140-142, 144, 146, 148, 150, 152, 154.

Centralized chip and oil reclaiming plant has paid for itself in approximately two years of operation.

20-397. **Small Drills are Important Tools.** K. H. Luther. *Modern Machine Shop,* v. 18, Sept. '45, pp. 160, 162, 164, 166, 168, 170, 172, 174.

Presents some of the results of research in the grinding and use of small drills.

20-398. **The Art of Metal Cutting, Part X.** *Machine Tool Blue Book,* v. 41, Sept. '45, pp. 156, 158, 160, 162, 164, 166, 168, 170.

Technique for the milling of cast iron and the non-ferrous materials such as aluminum, magnesium and plastics. Only in a few incidentals does the method of machining vary.

20-399. **Recent Progress in Milling Machine Operations, Part II.** C. W. Hinman. *Machine Tool Blue Book,* v. 41, Sept. '45, pp. 174, 176, 178, 180, 182, 184, 186, 188, 190, 192.

Hand milling machines.

20-400. **Maximum Results from Borizing.** C. G. Nordmark. *Machine Tool Blue Book,* v. 41, Sept. '45, pp. 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222.

Typical set-ups designed for high production on a precision basis are described.

20-401. **Interchangeable Fixtures Developed for Machining Superfortress Spars.** Leon Mooradian. *American Machinist,* v. 89, Sept. 13, '45, pp. 110-112.

Special routing templet clamping fixtures assure contour accuracy of aluminum spars. Phototemplets are used to guide set-up changes and insure reproduction of contours to lofted dimensions.

20-402. **Direction of Adjustment Affects Cutter Efficiency.** R. R. Weddell. *American Machinist,* v. 89, Sept. 13, '45, p. 112.

Milling cutter blades generally show maximum wear on the peripheral edge while the face remains comparatively sharp. Consideration of this fact and a modified disposition of the inserted blades in cutters results in maximum life with minimum grinding.

20-403. **Cemented Carbide Ways Increase Accuracy of Tool Grinder.** James R. Longwell. *American Machinist,* v. 89, Sept. 13, '45, pp. 118-119.

Replacement of cast iron dovetail slides and ways with cemented carbide members adds precision to profile grinding over long periods of service.

20-404. **Taper Turning Beyond Graduations on Standard Bench Lathe Compound.** Fritz L. Keller. *American Machinist,* v. 89, Sept. 13, '45, pp. 129-130.

Angular and cylindrical cuts taken in continued operation by using cross-slide to turn taper and compound-slide for cylindrical portion of work.

20-405. **Practical Ideas.** *American Machinist,* v. 89, Sept. 13, pp. 131-136.

Progressive punching tools avoid material loss. Adjustable fly-cutter increases accuracy and stops chatter. Portable machine faces many pipe flange sizes. Round guides replace V-ways for sliding journal boxes. Milling machine heads used for cutting caulking bevels. Thickness between counter-bored holes checked with turret gage. Micrometric lathe stop for close tolerance work. Broken drills removed from angle drill chucks. Pipe chuck adaptor for machining lapped-joint stub ends. Strap bending fixture for forming intricate shapes. Thin bar stock straightened by punch press holdown. Multiple cutting-off tool for producing spacer tubes.

20-406. **Carbides Cut Costs on Small Parts Production.** C. H. Speakman. *Production Engineering & Management,* v. 16, Sept. '45, pp. 67-70.

Used in non-cutting tools, cemented carbides are finding new and broader applications in metal working. Revealed here are carbide applications in which die life has been increased 100 times over that with conventional steel.

20-407. **Unique Boring Fixture Increases Product Output.** Gerald E. Stedman. *Production Engineering & Management,* v. 16, Sept. '45, pp. 73-76.

New diamond bore fixtures reduce salvage and downtime for adjustment. This new-type fixture virtually eliminates tool marks and enables consistent perfect spherical radius.

20-408. **Crusher Roll Profiling of Grinding Wheels.** A. W. Ehlers. *Tool & Die Journal,* v. 11, Sept. '45, pp. 115-118, 143.

Form tool of intricate profile and resultant high maintenance costs combine in an ideal test case for crusher roll profiling. Contributes valuable know-how to this relatively new technique, with promise of more to come. Using circular form tool as experimental crusher; final crusher roll design; life and grain characteristics of crushed wheel; silicon carbide crushing; roll crushing in production grinding; reversed crushing procedure; crushing surface speeds; feeds and coolants; roll crushing for centerless grinding.

20-409. **Connecting-Rod Production for the Napier Sabre Engine.** *Machinery* (London), v. 67, July 26, '45, pp. 85-90.

Connecting rods are of the usual forked and plain pattern, each pair of rods operating in conjunction with a steel split-shell big-end bearing which is lined internally and externally with lead bronze. The split-bush is gripped by the forked rod, but the plain connecting rod is free to

oscillate on the bush when the engine is in operation. The gudgeon-pin bores of both forked and plain rods are bushed, the bushes being shrunk into position and afterwards diamond-bored in the usual way. Confines attention to some of the more interesting operations employed in the production of the forked rod, a drawing of which is given.

20-410. **Mechanized Brazing.** *Machinery* (London), v. 67, July 26, '45, pp. 99-100.

Appreciable economies in time, fuel and compressed air have been effected in the brazing of under-carriage jacks for heavy bombers, compressed air bottles, and similar assemblies, by the use of a mechanically operated multi-blowpipe device. The complete brazing operation on each end of the under-carriage jack, for example, now takes only 2 min., as compared with 20 min. by previous hand methods.

20-411. **Machining Cylinder Heads and Sleeve Cranks.** *Machinery* (London), v. 67, Aug. 2, '45, pp. 113-118.

Machined from castings in light alloy. Design of the cylinder head is necessitated by the employment of sleeve valves which move on the cylinder heads with a combined reciprocating and turning motion, so that the heads may be likened to fixed pistons. To provide for cooling the cylinder heads when the engine is in service, the castings are hollow. Each casting has a ring groove machined in it, and in the finished engine it carries two sparking plugs.

20-412. **A Method of Grinding Boring-bar Cutters.** R. S. *Machinery* (London), v. 67, Aug. 2, '45, p. 119.

Difficulties overcome by making a simple block to hold the cutters and having faces machined to suit the cutter faces.

20-413. **Studies on the Machinability of Carbon and Alloy Steels.** G. P. Witteman. *Mechanical Engineering,* v. 67, Sept. '45, pp. 575-583.

Machinability of cold finished bars and parts produced from this material on what are commonly known as screw machines. Fundamentals of steelmaking; studies of machinability of steels; machinability essentials for automatic-machine product; determining quality from chips; microscopic examination of specimens; removing metal properly; machining alloy steels for ammunitions; suggested structures for machinable alloy steels.

20-414. **Contour Control Minimizes Hunting and Velocity Errors.** Oren G. Rutemiller and H. Earl Morton. *Machine Design,* v. 17, Sept. '45, pp. 103-107.

Utilizes duplicate controls; relief motors start cutting cycle; adjusts load automatically.

20-415. **Machining Aero-Engine Rocker Covers.** *Machinery* (London), v. 67, Aug. 9, '45, pp. 149-150.

Setting the casting in position; the milling operations.

20-416. **Securing Fine Surfaces.** H. J. Wills. *Machinery* (London), v. 67, Aug. 9, '45, pp. 151-152.

Lapping operations in the tool room. Silicon carbide compounds; diamond compounds; gage lapping.

20-417. Economic Systematic Setting of Automatic Screw Machines. G. B. Booth. *Machinery* (London), v. 67, Aug. 9, '45, pp. 152-153.

All set-ups for auto-screw machines should be provided with a cam design or tool layout sheet, giving necessary speeds, feeds, and tool positions. From this, the toolsetter should first complete all those operations that do not concern the action cycles, such as the changing of spindle gears, belting, etc. Cleaning agent, such as paraffin oil, should be handy, so that parts which may have to be dismantled may be refitted in a clean condition. This applies also to tooling to be returned to stores.

20-418. Stock Removal as a Measure of Tool Life and Power Consumption. G. Schlesinger. *Machinery* (London), v. 67, Aug. 9, '45, pp. 154-155.

By knowing the cutting area and choosing the cutting speed according to tool quality, material resistance, and wear properties, the rate-fixer can approximately calculate the net horsepower, and by assuming an efficiency for the machine tool, arrive at the total input horsepower and select a machine. Machine tool efficiency factor varies between 0.45 and 0.9 according to load, speed, degree of maintenance, and age of the machine tool. Thus, the rate-fixer requires a thorough knowledge of the plant; otherwise calculations will be wrong.

20-419. Laboratory Control in Machine-Tool Production. *Machinery* (London), v. 67, Aug. 16, '45, pp. 169-173.

Equipment and methods at the works of A. A. Jones & Shipman, Ltd. Checking surface finish with the profilometer; checking indexing wheels; using the Hilger Angle Dekkor.

20-420. Machining Group Forged Trip Levers. F. H. *Machinery* (London), v. 67, Aug. 16, '45, pp. 175-177.

The outline of the grouped forging; holding the work for the first operation.

20-421. Lapping Operations in the Production of Gears and Worms. H. J. Wills and H. J. Ingram. *Machinery* (London), v. 67, Aug. 16, '45, pp. 184-185.

Compounds for lapping gears; lapping compounds suitable for hypoid and spiral bevel gears; lapping worms and worm-gears.

20-422. A Symposium: Crush Dressing of Grinding Wheels for Form Tool Grinding. *Tool Engineer,* v. 15, Sept. '45, pp. 18-28.

Surface grinding of precision contours, by C. J. Wilson; The selection of wheels, by Leslie B. Bellamy; The tools for crush dressing, by L. A. Kitchen; The economics of crush dressing, by Wm. Moreland; Engineered crush dresses, by Gunnar Skog.

20-423. Abrasives and Their Uses in Industry. O. McIntyre. *Tool Engineer,* v. 15, Sept. '45, pp. 29-33.

Modern abrasives are cutting tools which may be infinitely formed for intricate shapes and high quality surface finishes.

20-424. From Tool Making to Simplified Broaching. Rex Heath. *Tool Engineer,* v. 15, Sept. '45, pp. 46-48.

New approaches to old problems lead to a new line of light production machines.

20-425. **Broaching—Important to Postwar Production.** *Western Metals,* v. 3, Sept. '45, pp. 18-20.

The principle of broaching; history of broaching; phenomenal operation; use of broaching in postwar production.

20-426. **Tool-Room Precision on a Mass Production Basis.** Charles O. Herb. *Machinery,* v. 52, Oct. '45, pp. 139-148.

Tolerances in tenths and split tenths are regular specifications in a New England shop that produces precision gears and high-grade special-purpose pumps.

20-427. **Initial Contact of Milling Cutter and Work-Piece.** M. Kronenberg. *Machinery,* v. 52, Oct. '45, pp. 149-156.

Importance of the initial contact between the teeth of a milling cutter and the work being milled has been largely overlooked in the past. Comprehensive study of this subject, calling attention to many factors that have seldom been taken into consideration.

20-428. **Rearrangement of Four-Spindle Drill Presses Increases Production.** *Machinery,* v. 52, Oct. '45, p. 157.

By changing the position of two idle spindle units of straight-line four-spindle drill presses so that two pairs of spindles are located back to back, and building auxiliary tables, a second production line was established from the previously unused spindles without interfering with original production line.

20-429. **Machine Grouping Eliminated Center-Wing Bottlenecks.** *Machinery,* v. 52, Oct. '45, pp. 162-165.

Eight machine tools set up as one unit for drilling, reaming, boring, and facing operations on airplane center wings constituted one of the outstanding manufacturing features at the Willow Run Bomber Plant.

20-430. **Milling Cutter Saves Ten Thousand Man-Hours a Year.** *Machinery,* v. 52, Oct. '45, pp. 166-167.

Designed especially for a particularly difficult milling operation on aircraft landing-gear struts, a new cutter has resulted in time and material savings, as well as in a better product.

20-431. **Ingenious Applications of Steel Balls in Machine Design.** *Machinery,* v. 52, Oct. '45, pp. 168-170.

Ball bearings can be used advantageously by engineers and designers in devices developed for a wide variety of purposes. Illustrations presented.

20-432. **Battery of Thirty-Two Automatics With Chip and Product Conveyor.** *Machinery,* v. 52, Oct. '45, pp. 171-172.

Machines mounted on a long bench, with a spacing of 24 in. between spindle centers. All machines can be set up to handle the same piece, or any desired number can be set up individually for different pieces and kept in continuous production with a minimum of attention.

20-433. **Ingenious Mechanical Movements.** *Machinery,* v. 52, Oct. '45, pp. 185-186.

Automatic magazine-feed attachment for centerless grinder.

20-434. **Friction Cutting of Metals by Band Saws.** H. J. Chamberland. *Machinery,* v. 52, Oct. '45, p. 188.

Production rates range from 24 to 60 linear in. on material ¼ in. thick, to from 6 to 20 linear in. on material ½ in. thick. Material as thick as ¾ in. has been cut successfully, but when the material is thicker than that, certain difficulties have been met, which, it is hoped, will be overcome through research and experiments. Table gives band-saw velocity, in feet per minute, recommended for different types of steel and cast iron.

20-435. **Fixture for Grinding a Helical Gage.** L. K. *Machinery* (London), v. 67, Sept. 13, '45, pp. 297-298.

Consists of a work-holding part supported on a carriage which is given a longitudinal movement, and means for imparting a partial revolution to the work during the longitudinal movement.

20-436. **A Rocket Production Line.** W. G. Miller. *Machine Tool Blue Book,* v. 41, Oct. '45, pp. 141-144, 146, 148, 150, 152.

New projectile line makes use of the best in materials handling and metal working techniques.

20-437. **The Art of Metal Cutting, Part X.** *Machine Tool Blue Book,* v. 41, Oct. '45, pp. 159-160, 162, 164, 166, 168.

Simple face milling.

20-438. **Versatility of the Ball, Part III.** H. F. Williams. *Machine Tool Blue Book,* v. 41, Oct. '45, pp. 175-176, 178, 180, 182, 184, 186, 188.

Modern machinery applications.

20-439. **Reconditioning Milling Cutters.** *Machine Tool Blue Book,* v. 41, Oct. '45, pp. 199-200, 202, 204.

Properly grinding and generally reconditioning milling cutters.

20-440. **Recommended Methods for Grinding Grooving or Slotting Tools.** Charles L. Hall. *Production Engineering & Management,* v. 16, Oct. '45, pp. 75-76.

Procedures for grinding, grooving or slotting tools by the tip-up method with a square face wheel and also grinding these tools with a dressed angle wheel.

20-441. **Labor Saving Tooling Developed by Navy.** *Production Engineering & Management,* v. 16, Oct. '45, pp. 90-91.

Rotary fixture cuts time on milling operation; robot hopper feeds screw machine automatically; dual disks provide simple deburring machine; checking attachment cuts time on hobbing hobs.

20-442. **High Production With Inexpensive Equipment.** *Production Engineering & Management,* v. 16, Oct. '45, p. 92.

Arrangement of standard tools and scrap material made possible the rapid processing of parts and voided the delay that the purchase of special equipment would have caused.

20-443. **Complicated Parts Produced by Broaching.** Harry H. Gotberg. *Production Engineering & Management,* v. 16, Oct. '45, pp. 94, 96.

Indicating wide versatility, broaching is being used for rough and finish machining of complicated parts. Pull-

down broach machines are equipped with indexing and shuttling table and interchangeable broaches designed for low-cost maintenance.

20-444. **Milling Cast Iron With Carbides.** Michael Field and W. E. Bullock. *Mechanical Engineering,* v. 67, Oct. '45, pp. 647-658.

Equipment used in investigation; testing procedure; scope of investigation covered in paper; discussion of results; cost of milling. 9 ref.

20-445. **Carbide Milling of Steel.** A. W. Meyer and F. R. Archibald. *Mechanical Engineering,* v. 67, Oct. '45, pp. 659-667.

Steels selected for test specimens; types and sizes of cutters; condition of tools after tests; soft steels; use of coolants; hard steels; multiple-tooth cutters; finish obtained.

20-446. **Cadillac War-Job Tooling.** Bartlett West. *Modern Machine Shop,* v. 18, Oct. '45, pp. 124-128, 130, 132, 134.

Tools developed by an automobile manufacturer to speed the war effort.

20-447. **Designing and Using Milling Cutters and Fixtures, I.** C. W. Hinman. *Modern Machine Shop,* v. 18, Oct. '45, pp. 138, 140, 142, 144, 146, 148, 150, 152.

Milling methods and their relation to cutter design.

20-448. **The Army's Modern Machine Ship.** *Modern Machine Shop,* v. 18, Oct. '45, pp. 198, 200, 202, 204, 206, 208.

Ordnance Department has put a barge under a full-fledged machine shop and sent it out to sea. Made up of experienced machinists, welders, toolmakers, heat treaters, and other mechanics and artisans, the equipment includes lathes, milling machines, shapers, drill presses, grinders, heat treating equipment—anything necessary for maintenance of fighting equipment.

20-449. **Ideas From Readers.** *Modern Machine Shop,* v. 18, Oct. '45, pp. 214, 216, 221-222, 224, 226, 228, 230.

Drill holder controls depth of holes. Fixture for checking tapers. Gear assembling fixture. Countersinking jig for aircraft work. Emergency inside micrometer for large work.

20-450. **Improved Tooling.** G. Eldridge Stedman. *Steel,* v. 117, Oct. 8, '45, pp. 112-116, 118, 178.

Aids Southern plant in stepping up output per worker from $2985 to $6179 per year.

20-451. **The Cutting Tools of World War II.** Malcolm F. Judkins. *Metal Progress,* v. 48, Oct. '45, pp. 901-904.

Outstanding things which were learned about metal cutting and metal cutting materials. Cutting efficiency of high speed and other toolsteels was sacrificed if tungsten and vanadium were limited in content. Conservation program was necessitated by the demands of the armed forces. Cutting of hard, tough, and heat treated materials was thoroughly feasible with carbide tipped tools. Metal could be removed at the highest rate by carbide tools. Possible to machine parts for closely fitting mechanisms to much narrower tolerances.

20-452. **Two-Spindle Milling Head Simplifies Grooving of Turbine Parts.** Ernest Miekley. *American Machinist,* v. 89, Oct. 11, '45, pp. 110-112.

Stainless steel workpieces are held in an air-operated fixture developed by Hendy engineers to increase production of the parts.

20-453. **The Disposal of Surplus Tools, I—The Problem.** Benjamin W. Corrado. *American Machinist,* v. 89, Oct. 11, '45, pp. 123-126.

Disposal of government surplus tools will not be easy for RFC officials charged with this responsibility. Priorities difficult; employment a factor; ten years' output; surplus ratio.

20-454. **The Disposal of Surplus Tools, II—Moving Toward the Solution.** *American Machinist,* v. 89, Oct. 11, '45, pp. 126-130.

Prospects posted; sales F.O.B.; disposal sites.

20-455. **Practical Ideas.** *American Machinist,* v. 89, Oct. 11, '45, pp. 131-136.

Machine vise for bandsaw cutting thin-walled alloy steel tubes. Loose thread mandrel holds tubular work on center. Long-radius milling attachment machines accurate curves. Accurate machine tapping replaces hand tapping. Spray gun mask shields welded joints from paint. Long small-diameter pulley fastened securely to shaft. Portable grinder converts lathe to surface grinding. Indexing fixture for use in regrinding punches. Eight-station indexing head for automatic milling operations. Balancing heavy pipe to facilitate handling on the welding bench. Lapping small holes quickly with interlocked cotter pins. Indicator gage checks limits of inside dimensions rapidly.

20-456. **Storage of Surplus Government Machines.** *American Machinist,* v. 89, Oct. 11, '45, p. 139.

Importance of proper preparation; special preparation required for open storage; skids used for protection; contracting for preparation; inspection prior to shipment.

20-457. **Rubber Tooling in Naval Gun Production.** A. W. *Machinery* (London), v. 67, Aug. 23, '45, pp. 197-204.

In many of the special tools employed, rubber is used either for guiding purposes or for expanding abrasive stones radially in the honing on internal surfaces. Rubber is used instead of hard wood for packing the bit tools employed in boring the guns.

20-458. **Spherical Turning Head Attachment for Boring Mill.** A. F. F. *Machinery* (London), v. 67, Aug. 23, '45, pp. 207-208.

Spherical bearing seat machined in the shell and held to a tolerance of ± 0.001 in. A horizontal floor-type boring machine is used as the power unit for driving the attachment. The attachment can also be used on a vertical boring mill or, with suitable holders, on a lathe or a drill press.

20-459. **Diamond Hones.** F. Whitehead. *Aircraft Production,* v. 7, Sept. '45, pp. 442-443.

Important development for finishing simultaneously the interior and exterior of Hercules cylinder sleeves.

20-460. **Machining Practice for Magnesium Castings.** H. E. Linsley. *Aluminum and Magnesium,* v. 1, Sept. '45, pp. 12-14, 21.

Certain points of difference occasioned by the nature of the metal itself which require the application of specific techniques. Easy machinability and consequent low power consumption offer an unusual opportunity for the use of multiple-spindle, multiple-operation machine tools, with a resultant reduction in manufacturing costs. Focuses attention on some of the major difficulties to be encountered, and suggests ways in which these may be overcome.

20-461. **Surface Broaching in an Aircraft Factory.** *Machinery* (London), v. 67, Aug. 30, '45, pp. 225-231.

Method for joining together the various spar-boom members of Vickers aircraft. The ends of the booms, which are made from tubular extrusions in light alloy, are specially serrated to suit complementary serrations in joint plates, and the booms and plates are bolted together.

20-462. **Indexing Blocks Simplify Grinding Operations.** *Machinery* (London), v. 67, Aug. 30, '45, pp. 233-234.

Surface grinders equipped with a magnetic table chuck can be used advantageously for grinding square, hexagonal, and other shapes by the use of simple indexing blocks. These comparatively simple blocks make it possible to handle work that would otherwise require the use of an expensive indexing head.

20-463. **Special Duplex Saw Squares Extrusion Ends Accurately.** *American Machinist,* v. 89, Sept. 27, '45, pp. 110-112.

Pneumatic stamping units used for adequate support at the cut. The saw heads swivel to required angles and safety devices protect the operator.

20-464. **Drill Press "Merry-Go-Round" Coordinates Operations on Fuze Parts.** *American Machinist,* v. 89, Sept. 27, '45, pp. 124-125.

Two drill presses set-up back-to-back for assembling, drilling and riveting of two parts in an efficient style.

20-465. **Practical Ideas.** *American Machinist,* v. 89, Sept. 27, '45, pp. 131-136.

Direct-reading protractor for correction of static unbalance. Changing order of operations boosts production 30%. Both hands control work when foot switch is used. Single plane adjustable drill jig accurately locates angular holes. Index plate on lathe chuck for accurate angular laying-out. Toolbit grinding fixture for front and side rake. Close tolerance and concentricity held by expanding boring fixtures. Fork lift operator lifts flat boxes without help. Universal gaging fixture for shouldered machine parts. Back-stop permits facing thin metal in a lathe chuck. Trap-door basket discharges heat treated parts quickly. Ball-bearing rollers speed laying-out and burning.

20-466. **Milling Heavy Sections of 14S-T Aluminum Alloy.** *Iron Age,* v. 156, Oct. 18, '45, pp. 62-63.

Good results cannot be obtained unless the cutters are kept sharp. Carefully balanced flywheels attached to the spindles were found to be important in reducing vibration and producing smooth operation of the machine. Successful results were obtained only with positive rakes. Heavy burrs left at the edges and ends of each surface necessitated a deburring operation. Tool and cutter design varies for each application.

20-467. **Multiple Borizing Setups.** C. G. Nordmark. *Steel,* v. 117, Oct. 1, '45, pp. 106-109, 142.

Ingenuity in working out a simple way to handle complicated jobs. Production quadrupled over former methods in certain instances. Holes bored simultaneously; support incorporated in fixture.

20-468. **Self-Actuating Machine Tools Command Increasing Attention.** Guy Hubbard. *Steel,* v. 117, Oct. 1, '45, pp. 116-117.

Trends toward shorter hours and higher pay accentuate interest in labor-aiding machinery as major factor in preventing costs of manufactured products from rising sharply.

20-469. **Trends in Metal Cutting Are Clearly Indicated by Cincinnati ASME Sessions.** Guy Hubbard. *Steel,* v. 117, Oct. 15, '45, pp. 121, 184.

Refinements in cutting tools inspire redesign of machine tools which in turn inspire revision of thinking among engineers.

20-470. **Special High Production Units are Featured in Cylinder Machining Line.** G. W. Birdsall. *Steel,* v. 117, Oct. 22, '45, pp. 108-110.

Operations in the machining line set up for finishing the castings that constitute the main frame and cylinder of 4-cycle single-cylinder air-cooled gasoline power plants.

20-471. **Simplified Tools Designed for Broaching Spline Forms.** H. H. Gotberg. *American Machinist,* v. 89, Oct. 25, '45, pp. 107-110.

Involute splines gain favor as requirements call for stronger and more accurate connections. Design of broaches and methods of spline production outlined.

20-472. **Aluminum Alloy Parts Drilled With Two-Position Set-Up.** Charles H. Bodner. *American Machinist,* v. 89, Oct. 25, '45, p. 111.

Time-saving arrangement steps up production of parts from 60 pieces in 8 hr. to 300 pieces in 8 hr.

20-473. **Universal Fixtures Simplify Radius Lip Grinding.** Arthur Cuppet. *American Machinist,* v. 89, Oct. 25, '45, pp. 112-113.

Development of simple fixtures for use on an Ex-Cell-O tool grinder. Set-ups which have proven satisfactory are shown.

20-474. **Table Feed Increased 15-Fold With Negative-Rake Cutters.** J. Q. Holmes and R. C. Holloway. *American Machinist,* v. 89, Oct. 25, '45, pp. 137-138.

With carefully ground cutters having cushioned carbide-tipped teeth, it is possible to take fairly heavy cuts in alloy steel in one pass and get good finish.

20-475. **Practical Ideas.** *American Machinist,* v. 89, Oct. 25, '45, pp. 139-144.

Slots milled in beryllium-copper tubes without causing deformation. Machining operations shortened by face-plate fixture. Honing machine stones fully utilized by re-working the wedges. Tool for inserting or removing fasteners in difficult places. Bisecting dividers locate centers of large circles. Holes punched in hat section with locator on brake dies. Ends of cylindrical gages ground flat and square with accuracy. Combination saw fixture for cutting unusual shapes. Adjustable tube checking fixture saves fitting time. Collet type indexing fixture for production with accuracy. Self-adjusting vise fixture holds pieces during machining. Arbor bracket adapts milling machine for die sinking.

20-476. **Unique System of Automatic Control Can Handle 39-Function Cycle.** *Steel,* v. 117, Oct. 29, '45, pp. 106-108, 122.

Without depending on conventional cams, it gives precise, high speed repetitive performance over full working range of machine—at same time allowing immediate switch to manual operation without disturbing settings of automatic cycle.

20-477. **How to Remove and Replace Carbide Tool Tips.** *Steel,* v. 117, Oct. 29, '45, pp. 109, 145.

Several methods of removing carbide tips from cutting tools are employed by the various divisions of the General Motors Corp. Such removal of tips offers a means not only of subsequently reclaiming the carbide for application on a different tool or for breaking up and resintering into a new shape, but also permits a new tip to be placed on the same tool shank so that it can be continued in use.

20-478. **Self-Opening Stud Driver.** *Steel,* v. 117, Oct. 29, '45, p. 138.

Incorporates automatic take-up for wear on jaws; affords exceptionally accurate maintenance of projection heights.

20-479. **Precision Boring With Gun Drills.** William Lawrence Lewis. *Western Machinery and Steel World,* v. 36, Oct. '45, pp. 434-437, 479.

By the use of modern, highly developed tool steels and Carboloy cutting bits, an old tool transformed into a new, highly productive one.

20-480. **Machine Tooling at Northrup.** Frank Morris. *Western Machinery and Steel World,* v. 36, Oct. '45, pp. 438-441.

Turret milling head; rotary drill jig cowling flap; cowling skin shear; automatic machine for installing Dzus fastener; Graumet rings and buttons.

20-481. **Die-Grams.** Karl L. Bues. *Western Machinery and Steel World,* v. 36, Oct. '45, pp. 476-477.

One of many interesting tools which the tool engineers

and the toolmakers at the Friden plant have had to create and build to produce a precision product at a reasonable cost.

20-482. **Taylor Instrument Engineers Development of Interesting Turret Lathe Job.** *Screw Machine Engineering,* v. 6, Oct. '45, pp. 52-54.

Case featuring the application of a high speed drilling attachment.

20-483. **Precision Gear Making at Swiss-American Gear Manufacturing Corporation.** *Screw Machine Engineering,* v. 6, Oct. '45, pp. 55-57.

For production turning and threading men.

20-484. **Drilling Small Holes in Stainless Steel.** G. J. Stevens and E. J. N. Lynn. *Screw Machine Engineering,* v. 6, Oct. '45, pp. 58-59.

Stresses, use of proper speeds and feeds, correct drill-jig designs, adequate chip clearance, and selection of a coolant. Modification of the drill-feeding technique is essential for work hardening alloys such as the non-magnetic 18-8 type stainless steels.

20-485. **Tool Abrasion in Machining Ceramics Controlled by Use of Carbides.** *Screw Machine Engineering,* v. 6, Oct. '45, pp. 60-61.

Tools tipped with Carboloy cemented carbide are used for three different classes of work: For turning unfired insulators on lathes; for drilling and counterboring unfired insulators on drill presses; for dies for pressing insulators made of highly abrasive materials.

20-486. **Machine of the Industry: Sheffield Form and Thread Grinder.** *Screw Machine Engineering,* v. 6, Oct. '45, pp. 66-73.

Multi-form wheel dressing; principal operating elements of Sheffield form and thread grinder; attachments for Sheffield form and thread grinder.

20-487. **Surface Broaching in the Production of Gun Components.** *Machinery* (London), v. 67, Sept. 20, '45, pp. 309-315.

Surface broaching has eliminated a number of milling and grinding operations on hammer-plate and has resulted in a reduction of the total machining, bench, and processing times, from 100¼ min. to 62 min. 10 sec.

20-488. **Drilling, Reaming and Centering Feeds for Automatic Screw Machines.** *Machinery* (London), v. 67, Sept. 20, '45, p. 315.

Gives drilling feeds in inches for mild steel and brass.

20-489. **Rolling Threads on Automatics.** *Machinery* (London), v. 67, Sept. 20, '45, pp. 317-322.

One of the most interesting of recent applications of this thread-rolling technique is the production of the 20-mm. shell nose on a 6-spindle automatic. To machine this component at one setting it is necessary accurately to form the nose, and in the same operation to produce 32 tpi. on a ⅝-in. diameter behind the nose. Set-up shown incorporates a thread-rolling attachment. Cycle time per piece is 13 sec., giving an hourly output of 206 shell noses at 75% efficiency.

20-490. **Compound-Angle Holes and Surfaces.** N. P. Skinner and K. L. C. Legg. *Machinery* (London), v. 67, Sept. 20, '45, pp. 323-326.

Discusses the necessary means of machining, including tooling equipment. Theoretical considerations.

20-491. **Hot-Shearing Blades.** A. T. Cape. *Steel,* v. 117, Nov. 5, '45, pp. 140, 178, 180.

Are made to last several times normal life when properly hard surfaced. Method not merely a salvage tool but valuable on original equipment as well.

20-492. **25 Per Second! 1500 Per Minute! 90,000 Per Hour!** *Tool & Die Journal,* v. 11, Oct. '45, pp. 96-97.

New press designed and built to blank and punch sheet metal parts at unprecedented speeds.

20-493. **Centralizing Drill Jig and Milling Fixture.** Alex S. Arnott. *Tool & Die Journal,* v. 11, Oct. '45, pp. 98-101.

Centralizing feature is made up of tool steel locators which are machined to a radius at their outer ends which will conform to the inside contour of the casting, and they are moved radially in and out in a straight line from the center of the jig by the movement of the centralizing plate, a section of which is shown.

20-494. **Blind Hole Tapping.** D. V. Bell. *Tool & Die Journal,* v. 11, Oct. '45, pp. 102-105.

The inherent difficulties in machining internal threads by the tapping method; solution of many of these problems, and newly discovered answer to the old question of how a lubricant reaches the edge of a cutting tool embedded in the material which it is machining.

20-495. **Hand Routing Setups.** *Tool & Die Journal,* v. 11, Oct. '45, pp. 106-107.

Tools, such as drills, rotary files, metal cutting saws, abrasive wheels, grinders, etc., are light enough to be operated without fatigue by a woman and, at the same time, provide excellent service.

20-496. **Machine Tool Control.** Ray A. Stremel. *Electronic Industries,* v. 4, Nov. '45, pp. 102-103.

Form and thread milling machine made fully automatic in operation through addition of vacuum tube control unit.

20-497. **Automatic Operation of Vertical Turret Lathes.** *Iron Age,* v. 156, Oct. 25, '45, pp. 68-69.

Certain structural changes in machine. These, together with the actual Man-Au-Trol unit, have resulted in the production of a new machine of remarkable flexibility.

20-498. **Efficient Polishing of Sintered Carbide Drawing Dies.** Walter Trurnit. *Industrial Diamond Review,* v. 5, Oct. '45, pp. 221-227.

Form or shape of the drawing die hole; new polishing process; requirements for a modern polishing shop. (Translated from *Stahl und Eisen,* v. 64, 1944, pp. 503-508.)

20-499. **Internal Gear-Grinding Machine.** H. Rectanus. *Industrial Diamond Review,* v. 5, Oct. '45, pp. 235-237.

Two flanks, including the space of a tooth, are ground simultaneously. For this purpose the form of the tooth

space is cut into the grinding wheel by two diamonds which are securely held on the same lever and which successively true both sides of the grinding wheel. (*Werkstattstechnik und Werksleiter*, v. 35, 1941, pp. 378-382.)

20-500. **Compound-Angle Holes and Surfaces.** N. P. Skinner and K. L. C. Legg. *Machinery* (London), v. 67, Sept. 27, '45, pp. 345-349.

Theory of compound angles, as applied in setting up workpieces for the accurate drilling of holes and production of surfaces discussed. Demonstrates how compound-angle workpieces may be set up in the workshop.

20-501. **Multiple Drilling and Boring Machine Has Hydraulically Operated Feed Table.** *Product Engineering*, v. 16, Nov. '45, p. 739.

Illustrations give details.

20-502. **Greater Threading Accuracy Obtained With New Lead Screw.** *Product Engineering*, v. 16, Nov. '45, p. 743.

Thread accuracy is held to strict specifications by a new principle of tap lead in the Warner & Swasey precision radial threading and tapping machine which has a tapping capacity from No. 8 tap, 36 pitch, to ⅞ in. Lead screw is hardened and precision ground.

20-503. **Fine Pitch Gears Inspection and Tolerances—III.** *Product Engineering*, v. 16, Nov. '45, pp. 758-760.

Presents standard covering a procedure for making comparator layouts for checking profiles of fine pitch gears and worms.

20-504. **Investigation on Cutting-Tool Angles.** M. Littmann and R. Neumann. *Engineering*, v. 160, Oct. 5, '45, pp. 261-263.

Influence of the shape of the tool on the direction of chip flow discussed. Problem approached from geometrical considerations.

20-505. **These Special Fixtures Speed Engine Mount Output.** Harry Merle. *Aviation*, v. 44, Nov. '45, pp. 152-153.

Picture story of a war-born production-boosting process has profit meaning for peacetime fabrication.

20-506. **Tool Tip Application Speeded by Induction Heating.** T. A. Verner and E. F. Adams. *Production Engineering & Management*, v. 16, Nov. '45, p. 71.

Better adhesion obtained and breakage reduced by use of series coil induction heating for tool tip mounting.

20-507. **Methods and Machines for Precision Gear Checking.** John E. Hyler. *Production Engineering & Management*, v. 16, Nov. '45, pp. 89-92, 94.

Established methods for measuring gears and recent developments in gear checking machines are described.

20-508. **Practical Safety Devices Reduce Shop Accidents.** John T. Smith. *Production Engineering & Management*, v. 16, Nov. '45, pp. 103-104, 106, 108.

Carefully designed machine tool guards, and a six-point safety program adaptable to most types of manufacturing.

20-509. **Profile Templet With Air Follower Whips Tricky Cylinder-Turning Job.** Carl H. Wilmot. *American Machinist*, v. 89, Nov. 8, '45, pp. 102-104.

Floating between a roller and a knife-point stylus, the bar assures increased production and maintains tolerance limits.

20-510. **Extrusions Drilled From End-to-End in Box-Type Stripping Jigs.** Conrad Mattson. *American Machinist,* v. 89, Nov. 8, '45, pp. 106-107.

Center support plates are used to guard against distortion in drilling wide extruded shapes. Special feed and clamp device is attached to cut-off saw unit.

20-511. **Correction Factors Simplify Odd-Tooth Gear Measurements.** *American Machinist,* v. 89, Nov. 8, '45, pp. 108-109.

Elimination of measurement and calculation errors in measuring odd-toothed gear diameters is an important advantage of this method of applying corrections.

20-512. **Practical Ideas.** *American Machinist,* v. 89, Nov. 8, '45, pp. 123-128.

Music wire straightened in lathe with revolving bent brass tube. Checking gage for grinding threading toolbits. Hinged drilling jig aids small drilling and tapping. Collmascope for testing optical windows for impressed strains. Ratchet tool quickly tightens inaccessible hose clamps. Spring center for lathe tapping. Worms cut on plain miller by geared attachments. Automatic electric marker for rapid wire cutting. Multiple-spindle drill head for closely spaced holes. Hydraulic feed unit prevents breakage of drills. Hinged gate permits loading of screw blanks as lathe turns. Piloted end mill improves accuracy and production.

20-513. **Contour Saw Chart for Various Materials—I and II.** *American Machinist,* v. 89, Nov. 8, '45, pp. 129, 131.

Based on the use of hard-edge flexible metal-cutting band-saw blades; the data can also be used for straight sawing, and skip-tooth or buttress-tooth saw blades.

20-514. **Plastics Dies and Punches.** *Aircraft Production,* v. 7, Oct. '45, p. 496.

New method for the cheap and speedy production of press tools.

20-515. **Shop Equipment and Small Tools.** *Aircraft Production,* v. 7, Oct. '45, pp. 497-498.

Some modern aids to efficient production. Cleaning coolant; locating pin; profile-turning roller box.

20-516. **Modern Machine Tools.** *Aircraft Production,* v. 7, Oct. '45, pp. 503-504.

Precision thread chasing; centerless thread rolling; slab milling.

20-517. **Production Processes—Their Influence on Design.** Roger W. Bolz. *Machine Design,* v. 17, Nov. '45, pp. 117-122.

Turret lathe is primarily suited for unusually shaped parts or heavy forgings or castings requiring large holding fixtures, long complicated shafts, parts where excessively heavy cuts are necessary, and complicated designs with a large number of finished surfaces. Basic turret lathe operations and their general sequence of occurrence are illustrated. Combinations and specialized variations of these are used to provide rapid, economical production.

20-518. **The Electric Variable-Speed Drive of Machine Tools.** M. Steinebrunner. *Engineers' Digest* (American Edition), v. 2, Oct. '45, pp. 490-494. *The Brown Boveri Review,* v. 31, no. 8, Aug. '44, pp. 251-260.

Practical examples are given to show how driving problems can be advantageously solved by employing electric stepless variable-speed drives.

20-519. **Diesel Engine Building.** Joseph Geschelin. *Automotive Industries,* v. 93, Oct. 15, '45, pp. 32-36, 38, 112, 114.

Gives few details of machining and assembly of engine parts. Elaborates on fabrication of main frame.

20-520. **Specialized Ground-Gear Production.** *Machinery* (London), v. 67, Oct. 4, '45, pp. 373-374.

Gear production department is fully equipped for machining of gear blocks, gear cutting, and gear grinding, and has its own heat treatment shop for the various normalizing, hardening, and other treatments required. Mechanical tests on forgings and completed gears; inspection section.

20-521. **Feeds for Form-Turning Brass on Automatics.** *Machinery* (London), v. 67, Oct. 4, '45, p. 379.

Table provides convenient source of reference for finding feed to be adopted in form-turning two ordinary specifications of brass on automatics.

20-522. **Cylindrical Grinding Speeds and Feeds.** S.S.S. *Machinery* (London), v. 67, Oct. 4, '45, pp. 380-381.

Effect of speeds and feeds on wheel action.

20-523. **Machining Parts for Steam Turbines.** Howard Campbell. *Modern Machine Shop,* v. 18, Nov. '45, pp. 124-130, 132.

Description of equipment and operation at Westinghouse Electric Corp.

20-524. **Designing and Using Milling Cutters and Fixtures, II.** C. W. Hinman. *Modern Machine Shop,* v. 18, Nov. '45, pp. 160, 162, 164, 166, 168, 170, 172, 174, 176, 178.

Uses and advantages of half-side milling cutters; formed milling cutters; cutting gear teeth.

20-525. **Blind Hole Tapping.** D. V. Bell. *Modern Machine Shop,* v. 18, Nov. '45, pp. 184, 186, 188, 190.

Discusses certain difficulties encountered in production tapping and suggests remedies.

20-526. **Turning Steel With Negative Rake Carbide Tools.** Carroll Edgar. *Modern Machine Shop,* v. 18, Nov. '45, pp. 196, 198, 200, 202, 204, 206.

Benefits from negative rake carbide tools are illustrated by a Michigan plant which turned out 5000 155-mm. shells per day over a period of many months. An average of 250 shells per grind was obtained with conventional carbide tools. When negative rakes were used, pieces per grind rose to an average of 400.

20-527. **Ideas From Readers.** *Modern Machine Shop,* v. 18, Nov. '45, pp. 212, 214, 216, 221-222, 224, 226, 228, 230.

Reducing waste on a drawing operation. Packing blocks for clamping dies. Reaming fixture ensures alignment of holes. End mill cleaning of semi-closed slots.

20-528. **Multiple Tapping of Magnesium and Aluminum.** *Machinery* (London), v. 67, Oct. 11, '45, pp. 399-404.

Practical solution to reduce tapping costs on aluminum and magnesium parts, expediting production, and reducing scrap work.

20-529. **Punches and Dies for B. A. Tapping Holes.** A. T. R. *Machinery* (London), v. 67, Oct. 11, '45, p. 408.

Table and illustration give dimensions for a one-operation piercing and plunging tool which will produce satisfactory holes in 16 and 18 s.w.g. material for tapping with 2 to 6 B.A. threads. All dimensions given are in inches.

20-530. **Drilling Wire-Holes in Nuts.** *Production & Engineering Bulletin*, v. 4, Sept.-Oct. '45, p. 368.

How a simple jig and drilling procedure eliminated the need for starting a drill on an inclined face and so reduced the breakage of drills.

20-531. **Giant Boring Bar.** *Steel*, v. 117, Nov. 12, '45, pp. 139-140, 142.

New installation yields accuracy to within 0.0005 in. boring 13-ft. diesel engine frames.

20-532. **Centerless Grinding of Screw Threads.** *Machinery* (London), v. 67, Oct. 18, '45, pp. 421-426.

Method has been successfully applied on a commercial scale to grinding of hardened socket set-screws from ⅛ to ⅝ in. in diameter, with pitches from 40 to 11 t.p.i. Thread diameters up to 12 in. have been successfully handled.

20-533. **Investigation on Cutting-Tool Angles.** M. Littmann and R. Neumann. *Engineering*, v. 160, Oct. 19, '45, p. 304.

Significance of different tool angles for actual cutting operations discussed from geometrical considerations.

20-534. **Nomographs for Analysis of Metal-Cutting Processes.** M. Eugene Merchant and Norman Zlatin. *Mechanical Engineering*, v. 67, Nov '45, pp. 737-742.

Nomographs are presented, based on previously derived equations, for convenient use in analyzing all orthogonal cutting processes wherein a continuous chip is produced (as distinguished from a segmental-type chip, such as occurs when machining cast iron).

20-535. **Development of Carbide Hobs for Cutting Marine Propulsion Gears.** Alfred J. Krogg and Richard W. Righter. American Society of Naval Engineers *Journal*, v. 57, Nov. '45, pp. 481-490.

Composite hob consists of a body with strips tipped with cemented carbide held in place by means of tapered wedges and set screws. Hob is approximately 6 in. in diameter, 6 in. long. Because of composite design it is possible to remove cutting edge strips and replace them with various types of cutting tool materials for test purposes.

20-536. **Investigation on Cutting-Tool Angles.** M. Littmann and R. Neumann. *Engineering*, v. 160, Oct. 26, '45, pp. 321-323.

Relations between various cutting tool angles studied by means of geometry considerations.

20-537. **Air Power—A Useful Metalworking Tool.** Ben C. Brosheer. *American Machinist*, v. 89, Nov. 22, '45, pp. 107-110.

Pneumatic operation of jigs, fixtures, chucks and other workholding devices proves worthwhile as factor in speeding production on many items. Contributes to safer and less fatiguing operations from a worker's standpoint. Permits the conversion of standard machines into automatic and semi-automatic units.

20-538. **How to Beat Chatter on a Long Inside Taper.** *American Machinist,* v. 89, Nov. 22, '45, pp. 118-120.

Readers suggest a taper reamer or added support for work and boring bar in machining this special piece. Rigidity gained by several ingenious solutions.

20-539. **Revised Gear-Blank Tolerances Cut Costs.** K. E. Bauerle. *American Machinist,* v. 89, Nov. 22, '45, pp. 132-135.

Revised gear-blank machining tolerances, sound design and proper evaluation of required quality puts instrument-gear manufacture on efficient basis.

20-540. **Practical Ideas.** *American Machinist,* v. 89, Nov. 22, '45, pp. 139-144.

Precision blade-grinding fixture built from scrap materials. Sensitive indicating calipers for plug gage work. Wire-cutting device has powerful leverage. Light weight portable stand for hand drill promotes accuracy. Inside micrometer provided with base for height-gaging work. Drill jig eliminates milling operation. Milling machine table stops advance accurate production. Elimination of burr caused by drill breakthrough. Universal router turntable cuts circles in large work. Developing of rolls for forming aluminum hat sections. Height-gage extension arm reaches difficult places. Shield makes screwdriver slip-proof for power use. Fixture holds eight tools for multiple grinding.

20-541. **Chase Euclid Case Plant Produces Brass Cartridge Cases and Steel Mortar Shells, Part II.** *Industrial Heating,* v. 12, Nov. '45, pp. 1880, 1882, 1884, 1886, 1918.

Continues with the processing operations, including continuous pickling, salt-pot annealing, induction silver soldering and final rough-finishing operations on the shell bodies.

20-542. **Turning Steel With Negative Rake Carbide Tools.** Carroll Edgar. *Western Metals,* v. 3, Nov. '45, pp. 22-23.

Design of negative rake tools; setup, machine considerations, etc.; use in finish turning; facing and boring.

20-543. **Continuous Methods in Cast Steel Bomb Production.** *Machinery* (London), v. 67, Nov. 1, '45, pp. 477-483.

Machining practice at the Stanton Gate Foundry.

20-544. **The Machining of Steel.** F. C. Lea and W. Medway. *Edgar Allen News,* v. 24, Nov. '45, pp. 516-518.

Double-angle cutters; equal-angle cutters; metal slitting saws; Sharpaform cutters; right-hand and left-hand cutters; cutter heads; end mills; shell end mills; formed cutters; reamers; shell reamers; hand reamers.

20-545. **The Influence of Modern Cutting Tools.** E. A. Greame. *Railway Mechanical Engineer,* v. 119, Nov. '45, pp. 524-525.

Carbides have demonstrated how to cut production time and increase tool life. Old machines not too well adapted to their use.

20-546. **Spring-Loaded Burring Tool.** Otha Gammon. *American Machinist,* v. 89, Dec. 6, '45, p. 95.

Can be used for any diameter and face width of gear within machine capacity. Eliminates hand burring and avoids danger of scratching or cutting operator's hands when he removes gear from mandrel.

20-547. **Pneumatic Slide Speeds Press Assembly Operations.** D. M. Grimm. *American Machinist,* v. 89, Dec. 6, '45, pp. 126-127.

Faster and safer hand loading of press die blocks provided by air-operated mounting slide synchronized with ram movement.

20-548. **High-Rake Flycutters Mill Precision Surfaces on Castings.** G. C. Becker. *American Machinist,* v. 89, Dec. 6, '45, pp. 128-129.

High-rake flycutters tipped with cemented carbide solved face-milling problems on thin-section aluminum, magnesium, brass and bronze castings. Minimized tool pressure and eliminated chatter and distortion in milling castings to precision tolerances.

20-549. **Practical Ideas.** *American Machinist,* v. 89, Dec. 6, '45, pp. 131-136.

Ingenuity eases the hard jobs. Device for cutting tapers will handle unusually large sizes. Portable ventilator expels fumes from confined areas. Mandrel faces heavy springs in compressed position. Rockered forming die makes variety of straps and hooks. Cable lugs attached by transformer soldering. Adjustable fixture holds small jigs on drill press table. Turntable principle speeds up press assembly operation. All-purpose drilling jig clamps in vise with work. Flush-pin gage checks thread depth accurately. Pneumatic hammer crimps lugs quickly and neatly.

20-550. **Cutter Design Evaluated by Production Runs.** A. O. Schmidt. *Iron Age,* v. 156, Nov. 22, '45, pp. 54-57.

After operation on long production runs under normal shop conditions and in competition with two other types of recent design, findings obtained definitely establish superiority of new design.

20-551. **Should Aircraft Engine Gears Be Ground?** E. A. Koether. *Tool & Die Journal,* v. 11, Nov. '45, pp. 97-98, 122, 124.

Study of production methods, the effect of grinding on gears and the relative effect of grinding upon the endurance limit of gears and gear tooth fatigue.

20-552. **Turning Steel With Negative Rake Carbide Tools.** Carroll Edgar. *Tool & Die Journal,* v. 11, Nov. '45, pp. 101-103. Also *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 155-156, 158, 160, 162.

Benefits illustrated by a Michigan plant which turned out 5000 155-mm. shells per day over a period of many months. An average of 250 shells per grind was obtained with conventional carbide tools. When negative rakes were used, pieces per grind rose to an average of 400.

20-553. **Drilling Hardened Steels.** F. G. Gepfert. *Tool & Die Journal,* v. 11, Nov. '45, pp. 110-111, 114, 116, 124.

New type of drill found ideal for drilling carburized, oil-hardened, water-hardened, cyanided and nitrided steels of Rockwell C-40 and higher hardness. Use eliminates annealing, remachining, rehardening, loss of many hardened parts, time and costly handling.

20-554. **Tool of Today Sets Production Pace for Tomorrow.** A. E. Rylander. *Tool Engineer*, v. 15, Nov. '45, pp. 40-42.

Man-Au-Trol, the electrical brain, converts standard Bullard machine tools to automatics and boosts production and repetition accuracy far beyond previous attainments.

20-555. **Unusual Machine Performs Many Varied Operations.** *Machinery,* v. 52, Nov. '45, pp. 157-159.

Combines vertical milling, side milling, end milling, drilling, reaming, and boring operations, so that one side of the work to be machined is completed with one clamping on the table. All feeds controlled hydraulically, with positive locating stops for each operation.

20-556. **Improved Methods for Lapping Radius-Formed Pivot Bearings.** *Machinery,* v. 52, Nov. '45, pp. 168-169.

Machine is designed to duplicate by mechanical means the motions previously employed in hand-lapping radius-formed pivots on wheel which have the same shape as the end of the punch shown and at the same time to eliminate inaccuracies which could not be avoided when the hand-lapping method was used.

20-557. **Negative Rake Turning.** Carroll Edgar. *Steel,* v. 117, Dec. 3, '45, pp. 132, 187.

With carbide tools; reduces chipping of cutting edge during machining of eccentric and scaled steel forgings.

20-558. **The Art of Metal Cutting, Part XII.** *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 141-142, 144, 146, 148, 150.

Carbide milling of steel. Series of operations on small and medium sized equipment considered.

20-559. **Recent Progress in Milling Machine Operations, Part III.** C. W. Hinman. *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 167-168, 170, 172, 174, 176, 178, 180.

Some typical jobs. Several drawings of tooling set-ups included.

20-560. **An Unusual Threading Job.** Gerald Eldridge Stedman. *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 412, 414-416, 418, 420, 422, 424, 426, 428.

Reflecting itself in the cost of the completed part. In this instance, and as a result of improved machining, Kay Mar cut the cost of thread cutting over 65%.

20-561. **Effect of Work Position in Face Milling.** Fred W. Lucht. *Iron Age,* v. 156, Dec. 6, '45, pp. 72-76.

Describes in detail careful procedure employed for determining the effects of varying work positions upon tool life. (Presented at the fall meeting of the ASME in Cincinnati.)

20-562. **Tooling the Automatic Screw Machine, XIV.** Noel Brindle. *Modern Machine Shop,* v. 18, Dec. '45, pp. 124-132, 134, 136.

Burring attachment—its uses and advantages.

20-563. **Ideas From Readers.** *Modern Machine Shop,* v. 18, Dec. '45, pp. 206, 208, 210, 212, 214, 216, 221.

Broaching in the lathe. Bolt serves as bushing press. Universal die nest from scroll chuck. Air stripper for riveting machine. Reamer expansion method is patented.

20-564. **Power Hacksaw Blades for Sawing Seamless Steel Tubing.** William Gustafson. *Screw Machine Engineering,* v. 7, Nov. '45, pp. 54-58, 60-62.

Armstrong-Blum metal sawing machine used; tubing used as material for inner and outer rings; importance of the saw blade in obtaining satisfactory results at the metal sawing operations; some pertinent data concerning the performance of the special design power metal sawing machine blades; comments concerning test data sheets collected in study.

20-565. **Production Possibilities With Hot Pressed Brass Forgings and Pressure Die Castings.** *Screw Machine Engineering,* v. 7, Nov. '45, pp. 64-70.

Details some of the production opportunities which are possible when hot pressed brass forgings and pressure die castings are machined. Brief examination is based upon these major points: Consolidation of component parts, simplification of processing operations, accommodating machining operations to nature of material machined, list of uses for pressure die castings and hot pressed brass forgings, pressure die castings on production turning and threading equipment.

20-566. **Stock for Automatics.** John E. Hyler. *Screw Machine Engineering,* v. 7, Nov. '45, pp. 72-75.

Important factors relating to the type of stock used; points to remember when selecting stock for automatics; brass and steel.

20-567. **Production Sizing of Special Shaped Rod.** Arthur Edick. *Screw Machine Engineering,* v. 7, Nov. '45, pp. 81-89.

Featuring outstanding production case histories at Remington Rand's Tabulating Machines Div. Plant.

20-568. **Efficient Production of Rock Bit Drills on Automatic Chuckers.** *Screw Machine Engineering,* v. 7, Nov. '45, pp. 90-95.

Gross production time per piece on both chuckers is 1 min., 45 sec., or 31 pieces per hour. Minimum of handling is involved, since the forgings are routed directly to the first automatic chucker set-up, from there are sent to the milling machine and then back to the second automatic chucker, after which they are hardened and ground.

20-569. **Processing Magnesium Alloy Screw Machine Products.** Robert Chestnut. *Screw Machine Engineering,* v. 7, Nov. '45, pp. 96-101.

Magnesium alloy stock for automatics; machining characteristics of magnesium alloys; types of tool materials for machining magnesium alloys; turning tools; drills; coolants used when machining magnesium alloys; protective coatings for magnesium alloys; fire prevention when machining magnesium alloys.

20-570. **Carbide Comes to Files.** Philip Collins McKenna. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 504-506.

File has inserts of Kennametal, with serrations having a shear angle of 30° and a 15° negative back rake. Cuts cleaner and is less liable to clog up than the positive rake steel file. Non-galling property of steel cutting grades of carbide, containing $WTiC_2$, helps to shed the chips from the cutting surfaces.

20-571. **Broaching Methods and Applications.** Harry H. Gotberg. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 510-513, 535.

Broach design; types and applications of broaching machines; operating considerations.

20-572. **Neoprene Improves Action in Drill Chuck.** *Product Engineering,* v. 16, Dec. '45, p. 833.

Permits wider range of drill sizes and keeps the jaws in better alignment.

20-573. **The Production of Ground Helical Gears.** *Machinery* (London), v. 67, Nov. 15, '45, pp. 518-521.

Describes various machines developed by Gear Grinding Co., Ltd.

20-574. **German Special-Purpose Horizontal Boring Machines.** R. H. P. Nott. *Machinery* (London), v. 67, Nov. 15, '45, pp. 541-545.

Describes in some detail various German machines designed to speed up production of parts for internal combustion engines, in the manufacture of which majority of machining problems are related to boring.

20-575. **Tooth Design Formulae for Angular Milling Cutters and Taper Reamers.** L. W. Silk. *Machinery* (London), v. 67, Nov. 15, '45, pp. 549-550.

Provides for correct dividing-head setting angle together with amount of depth to sink the cutter.

20-576. **New and Improved Methods for Automobile Cylinder Processing.** Frank M. Scotten. *Production Engineering & Management,* v. 16, Dec. '45, pp. 73-76.

Technological developments in cylinder processing indicate shorter, scuff-free, break-in periods and lengthened engine life. Closer tolerances being achieved on machining operations and new metal-treating process is being applied to assure better product performance.

20-577. **Universal Tool Application for Diversified Products.** *Production Engineering & Management,* v. 16, Dec. '45, pp. 78-88.

Careful product engineering and well-planned plant layout make possible universal application of machine tools for manufacture of parts for diesel engines in a wide range of sizes. Multiplex operation machines increase product output.

20-578. **Grinding Clearance on the Side Angle of Cutting Tools.** Charles L. Hall. *Production Engineering & Management,* v. 16, Dec. '45, pp. 94, 96.

Formulas establish corrected angle to be used when

dressing wheel for grinding a clearance on the side angle of cutting tools with tool held in different positions.

20-579. **Bullard Man-Au-Trol Introduces New Operating Efficiencies.** *Production Engineering & Management,* v. 16, Dec. '45, pp. 148, 150-151.

Cumulative error on multiple operations eliminated and maximum production obtained by addition of automatic control to vertical turret lathes. Instant conversion to manual operation and return to automatic operation also provided.

20-580. **Automatic Centering Machine.** *Steel,* v. 117, Dec. 17, '45, p. 99.

Simultaneously produces accurate, properly lined-up center holes in each end of a piece of stock.

20-581. **Machinability of Sulphurized Steels.** H. M. Clarke. *Steel,* v. 117, Dec. 17, '45, pp. 116, 119, 162.

Experience in high speed machining of sulphite treated alloys shows that increases in production and tool life may be expected with this form of sulphur addition. 4 ref.

20-582. **The Allison Octopus.** P. D. Aird. *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 137-138, 140, 142, 144, 146, 148.

Gives design and construction details of special nine-spindle boring machine.

20-583. **The Art of Metal Cutting, Part XII.** *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 155-156, 158, 160, 162, 164, 166, 168, 170.

Carbide milling of the light alloys.

20-584. **Your Grinding Wheels—Right or Wrong?** J. F. Fischer. *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 177-178, 180, 182, 184, 186.

Selection must be based on adequate knowledge of what governs action of grinding wheel, how wheels are made, and what markings mean.

20-585. **Drilling Hardened Steels.** F. G. Gepfert. *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 245-246, 248, 250, 252, 254, 256, 258, 260.

Use of "Hardsteel" drill eliminates annealing, re-machining, re-hardening, loss of many hardened parts, time and costly handling.

20-586. **"Ersatz" Cutting Tools.** *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 265-266, 268.

Discusses substitutes for tungsten carbide used by Nazis.

20-587. **Effect of Work Position in Face Milling.** Fred W. Lucht. *Iron Age,* v. 156, Dec. 13, '45, pp. 64-68.

Analyses the causes of tooth failure at various angular positions of work, and describes effects of changes in corner angle of tool

20-588. **Setup Charts for Bullard Mult-Au-Matics.** John J. Meadows. *Iron Age,* v. 156, Dec. 13, '45, pp. 54-58.

Charts presented to enable setup man to see at a glance correct pair of change gears for each spindle speed and rate of feed.

SECTION XXI

LUBRICATION AND FRICTION

21-1. **Action of n-Primary Alcohols as Metal Cutting Fluids—Alternating Properties with Chain Length.** Milton C. Shaw. *American Chemical Society Journal*, v. 66, Dec. '44, pp. 2057-2059.

An alternation in the cutting force required to remove a chip from an aluminum block at very low cutting speed is noted when successive normal, primary, monohydric alcohols are used as cutting fluids. Alcohols having an odd number of carbon atoms require lower cutting forces than the compounds having an even number of carbon atoms.

21-2. **Water and Composition Roll Neck Bearings.** J. P. Sweeney. *Iron & Steel Engineer*, v. 21, Dec. '44, pp. 83-85.

Factors influencing the performance of composition bearings on roll necks. Water temperatures should not exceed 113° F.

21-3. **The Manufacture of Grease.** L. P. Lochridge. *Iron & Steel Engineer*, v. 21, Dec. '44, pp. 86-89.

Grease making has been lifted to a scientific procedure. Although accurate testing procedure is used to control grease manufacture, actual service tests must be the final criterion of application.

21-4. **Engine Reconditioning.** *Automobile Engineer*, v. 34, Dec. '44, pp. 523-529.

Production control system, and the question of under and over sizes for bearings. Equipment for cylinder reboring and crankshaft regrinding is dealt with. Reasons for adopting modifications given. Reference is made to rebabbitting equipment and the machines specially designed for boring bearings.

21-5. **A New Experimental Approach to the Study of Boundary Lubrication.** E. N. Dacus, F. F. Coleman and L. C. Roess. *Journal of Applied Physics*, v. 15, Dec. '44, pp. 813-824.

Apparatus for measuring the relative ability of rubbed-down mono layers of polar lubricants to maintain low friction under test conditions which do not permit replacement of the lubricant. This quality of a lubricant is called its "durability." The clean polished rim of a slowly rotating steel wheel rubs on the monolayer deposited on a polished steel flat.

21-6. **Current Developments in Industrial Lubricants.** G. F. Bowers. *Iron & Steel Engineer,* v. 22, Jan. '45, pp. 48-51.

Under the stress of war demands, developments in lubricants have proceeded rapidly. Many of the improvements will be of assistance in improving the economy of postwar operations.

21-7. **Ford Develops Tri-Alloy Bearing.** Leonard Westrate. *Automotive Industries,* v. 92, Jan. 15, '45, pp. 20-21, 96.

The new bearing will give from two to three times the service life of conventional bearings, even under the most severe conditions. Another advantage is said to be its ability to stand up under heavy load at high speed operation. The tri-alloy material consists of 35 to 40% lead, 4½ to 5% silver, and the balance copper, with a trace of iron.

21-8. **Static and Clinging Friction of Pivot Bearings.** M. C. Hunter. *Institution of Mechanical Engineers,* v. 151, Dec. '44, pp. 274-282.

Distinction to be drawn between kinetic and static friction. Describes the special apparatus used to determine the static friction of various combinations of metals, including stainless steel and duralumin, under several conditions of dry and viscous lubrication.

21-9. **Piston-Ring and Cylinder Wear in Automobile-Type Engines.** P. V. Lamarque. *Engineering,* v. 158, Dec. 22, '44, pp. 497-500.

Summarized information which is normally somewhat scattered. Lubrication; scuffing.

21-10. **Testing Lubricants and Bearing Materials.** V. H. Brix. *Aircraft Engineering,* v. 16, Dec. '44, pp. 361-362.

Description of a useful Rolls-Royce testing machine.

21-11. **Investigation of Friction and Wear Under Quasi-Hydrodynamic Conditions.** R. G. Larsen and G. L. Perry. American Society of Mechanical Engineers *Transactions,* v. 67, Jan. '45, pp. 45-50.

Laboratory study of the factors which influence friction and wear by additive-containing mineral oils under conditions intermediate between those of hydrodynamic and true boundary lubrication. The concentration of a number of sulphur and phosphorus compounds required for minimum wear varies over a wide range. The minimum effective concentration is determined by the presence in the molecule of acidic groups which concentrate the additive at the wearing surfaces. Under the conditions of these experiments it appears that wear is predominantly a corrosion process.

21-12. **The Friction Properties of Various Lubricants at High Pressures.** John Boyd and B. P. Robertson. American Society of Mechanical Engineering *Transactions,* v. 67, Jan. '45, pp. 51-59.

In connection with certain problems associated with the manufacture and punching of laminated stock, an

investigation was made of the friction properties of various special lubricants under high pressures. Results have been found useful in a number of special applications presented.

21-13. **Bearing Strength of Porous Iron Bushings.** E. Heidebrock. *VDI Zeitschrift*, v. 88, no. 15-16, April 15, '44, pp. 205-207.

The opinions concerning the applicability of porous iron bearings are contradictory. It seems that, only after consideration of all data from tests performed under the conditions of practical application, the possibility of the use of such bearing may be determined in each individual case.

21-14. **Adequate Piston Cooling—Oil Cooling as a Means of Piston Temperature Control.** Gregory Flynn, Jr. and Arthur F. Underwood. *S.A.E. Journal*, v. 53, Feb. '45, pp. 120-128.

Increasing engine outputs have required methods to control the piston temperature; use of a piston of low conductivity, correlated with an appropriate rate of piston cooling oil from the engine lubrication system. The effects of coolant temperature, load, and speed over the propeller load curve, and a piston baffle, on piston temperatures are investigated by thermocouples silver soldered in a 6 x 6½-in. diesel, two-cycle piston. Tests indicate that the rate of cooling oil does not have to be excessive to secure adequate cooling. Substantiating data from an 8 x 10-in. diesel engine are given. Steel piston designs for use with jet oil cooling are shown. These are for the 6-in. diesel on which most of the data for the paper were taken.

21-15. **Measuring the "Existent Corrosivity" of Used Engine Oils.** R. G. Larsen, F. A. Armfield, and L. D. Grenot. *Industrial & Engineering Chemistry* (Analytical Ed.), v. 17, Jan. '45, pp. 19-24.

A test for determining the "existent corrosivity" of used engine oils independently of previous history provides a means for evaluating in simple fashion, by the use of test strips coated with lead or other metal in graduated thicknesses, a property of used oils not heretofore satisfactorily measured by routine engine oil tests. It also has practical application in determining the cause of bearing failures and indicating necessary oil drain periods. 13 ref.

21-16. **Friction of Ball and Roller Bearings.** *Machinery* (London), v. 66, Jan. 18, '45, pp. 69-72.

Data given on the effect of various factors affecting friction, i.e., design, lubrication, load and speed, and an attempt to correlate the information on the effect of speed on frictional torque. 8 ref.

21-17. **Oil and Material Recovery in an Aircraft Plant.** *Machinery* (London), v. 66, Jan. 25, '45, pp. 81-86.

The oil-recovery methods at a Rolls-Royce aero-engine factory.

21-18. **Lead-Base Babbitt.** R. G. Thompson. *Metal Industry*, v. 66, Jan. 26, '45, pp. 55-56.

Centrifugal and stationary casting techniques; when tin was readily available it was customary to use a composition of 83 1/3% tin and 8 1/3% each of copper and antimony for babbitt. Experience of the General Electric Co. of America in the use of low-tin bearing alloys.

21-19. **Bearing Corrosion Characteristics of Lubricating Oils.** C. M. Loane and J. W. Gaynor. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, Feb. '45, pp. 89-95.

Only practical correlation is that between laboratory tests and standard accelerated engine tests. Study is limited to a comparison of laboratory corrosion test results with Chevrolet 36-hr. test results. Demonstration of the enormous effect, specific to certain oils, of the several catalysts used. 14 ref.

21-20. **Lubrication.** *Automobile Engineer,* v. 35, Jan. '45, pp. 21-23.

Newer aspects created by super finishing.

21-21. **Notes on the Use of Coolants.** John E. Hyler. *Modern Machine Shop,* v. 17, March '45, pp. 136, 138, 140, 142, 144, 146.

A few pointers which should be useful to buyers and users of coolants.

21-22. **Lubrication in Deep Drawing Metals.** Samuel Spring. *Steel,* v. 116, March 19, '45, pp. 112-113, 150, 152, 154.

Nature of metal surfaces; types of friction; lubrication; reduction of friction. 18 ref.

21-23. **Additives in Oil for the Steel Plant.** C. E. Pritchard. *Iron and Steel Engineer,* v. 22, March '45, pp. 75-84.

Additives impart to an oil specific properties which are lacking in the conventionally refined petroleum product, enabling it to meet the requirements of specific applications.

21-24. **Positive Automatic Lubrication.** R. L. Harter. *Steel,* v. 116, March 12, '45, pp. 110-112, 114, 152, 154.

Both over and under lubrication are avoided, bearing failures prevented and important economies obtained through use of lubricating systems which synchronize rate of supply with rate of consumption.

21-25. **Gearing Lubrication Standard Set Up by A.G.M.A.** *Iron Age,* v. 155, March 15, '45, pp. 69-72.

American Gear Manufacturers Association standard covers the method of lubricating and the type and grade of oil to be used in enclosed gear drives and open gearing. It is applicable to various types of gearing.

21-26. **Lubrication in Deep Drawing Metals.** Samuel Spring. *Steel,* v. 116, March 26, '45, pp. 100, 102, 104, 132, 138, 140, 142, 144.

Defines and describes what occurs in "boundary" lubrication, implemented by physical or chemical adsorption; in "extreme pressure" lubrication with sulphurized oils and other types; and in "wear" effected

by abrasive or corrosive action, oxidation or welding of metals. 24 ref.

21-27. **Copper-Lead-Silver Bearings Developed by Ford.** *Iron Age,* v. 155, March 29, '45, pp. 50-51.

A high lead (35 to 40%) copper bearing containing 4½ to 5% silver. Silver prevents segregation of the lead and resultant fatigue. The new "tri-alloy" bearing will give two to three times the service life of conventional bearings even under the most severe conditions.

21-28. **Bearing and Tool Damage by Welding or Galling.** E. L. Hemingway. *Machinery* (London), v. 66, Feb. 15, '45, pp. 171-177.

Reasons and theory of galling, and gives pertinent data on how this action can be minimized. Bearing metals, and other important data on bearing performance discussed. (From *Iron Age.*)

21-29. **Lubrication in Deep Drawing Metals.** Samuel Spring. *Steel,* v. 116, April 2, '45, pp. 109-110, 158, 160, 162, 164, 166, 168, 170.

Application of lubrication theory to deep drawing, effect of engineering and metallurgical factors conducive to excessive welding of work and tools, prevention of buildup and seizure, and an interesting hypothesis on the mechanism of metal buildup on tools. 11 ref.

21-30. **Film Lubrication of Parallel Thrust Surfaces.** A. Fogg. *Engineering,* v. 159, Feb. 16, '45, pp. 138-140.

Determination of the load-carrying capacity of existing types of thrust bearing, such as the Michell bearing, under the special operating conditions. Systematic investigation of various modifications to a plain annulus. Loads of the same order of intensity could be carried on simple fixed pads.

21-31. **Oil Grooves in Plain Bearings.** D. Clayton. *Engineering,* v. 159, Feb. 23, '45, pp. 158-160.

Effect of holes and grooves on the behavior of plain bearings.

21-32. **Machine Lubrication.** G. W. Birdsall. *Steel,* v. 116, April 9, '45, pp. 110-113, 128, 130.

Can be made extremely profitable as shown by remarkable savings recorded from use of properly engineered centralized lubrication systems. Improved lubrication equipment provides outstanding economies by reducing time, manpower and lubricants required, while increasing bearing life and machine output.

21-33. **Lubrication in Deep Drawing Metals.** Samuel Spring. *Steel,* v. 116, April 9, '45, pp. 114, 116, 118, 120, 122.

General properties of drawing lubricants and their composition. Includes reduction of friction, ease of application and removal, stability, non-corrosiveness and economy. 6 ref.

21-34. **Lubrication Progress Paces Ball and Roller Bearing Developments.** *Lubrication,* v. 31, Feb. '45, pp. 13-24.

Trends in ball and roller bearing lubrication: High speeds; sealed bearings; wider speed limits; controlled lubrication; all-temperature greases; wider temperature ranges; prepacked grease lubrication; greater use of precision bearings; use of spray or oil-mist lubrication on high speed oil-sealed bearings; rust and oxidation resistant lubrication; means for re-lubricating sealed bearings.

21-35. **Oil Grooves in Plain Bearings.** D. Clayton. *Engineering,* v. 159, March 2, '45, pp. 178-180.

General behavior: (a) The coefficient of friction is low (generally less than 0.002). (b) Increase of speed leads to higher feed under all conditions, and to a slightly higher coefficient of friction; the latter actually indicates a greater safety, the decrease of viscosity due to rise of temperature not quite wholly compensating for the increase of speed. (c) The rate of change of bearing temperature with change of oil flow through the bearing very rapidly decreases as the quantity increases, the flow-temperature curve being hyperbolic in shape; so that cooling a bearing in this range of conditions by either pumping an excess of oil through it or cutting grooves to promote flow seems rapidly to become inefficient. The viscosity value, which represents, for constant other conditions, a rough measure of safety of the bearing, changes only 25% for the 8° C. (14° F.) lowering of the temperatures effected by cutting a 1½-in. axial groove at the bottom when the feed increases from 6 fluid oz. to 18½ fluid oz. per min. On the other hand, if a hole at 90° on the outlet side is replaced by one at the bottom, the temperature change is such that the safety increases by 75% or more for a four-fold increase of flow.

21-36. **Put It There.** Lee T. Miller. *Die Casting,* v. 3, April '45, pp. 20-21, 54-56.

Lubricating devices with die cast parts. Confronted with the necessity of maintaining a smooth exterior and with the object of a relatively simple die, the location of essential openings and bosses became important. Here's how it was done.

21-37. **Lubrication of Portable Air Tools.** A. F. Brewer. *Aero Digest,* v. 49, April 15, '45, pp. 90-93, 179-180.

Precise mechanisms; valve-controlled tools; air strainers; moisture causes rust; preventive maintenance.

21-38. **Chemistry and Prevention of Piston - Ring Sticking.** G. H. Denison and J. O. Clayton. *SAE Journal,* v. 53, May '45, pp. 264-268.

Oxidation of lubricating oils produces, among other products, oxy-acids, which constitute the source of ring sticking because of a tendency to turn into insoluble deposits. Chemical explanation of this phenomenon is given, so that it may prove useful in implementing the design of non-corrosive, anti-ring-sticking additives for heavy-duty oils.

21-39. **Corrosion Resistant Anti-Friction Bearings.** H. Habart. *Iron Age,* v. 155, April 19, '45, p. 70.

Corrosion resistant metals are being used in increasing quantities for the manufacture of anti-friction bearings. In general, these metals are divided into three classes: monel alloys, stainless steels and beryllium copper. Gives uses, advantages and disadvantages for each.

21-40. **Predicting Power Losses in Journal Bearings.** Charles D. Wilson. *Machine Design,* v. 17, May '45, pp. 125-130.

Power losses in large bearings are influenced by the rate of oil circulation and by the design of the unloaded portion of the bearing. Estimation of this worked out using curves derived from calculation and interpretation of test data discussed.

21-41. **Demulsifiers in Circulating Oil Systems.** T. G. Roehner and E. S. Carmichael. *Iron & Steel Engineer,* v. 22, May '45, pp. 62-68.

Persistent water-in oil-emulsions which occur in circulating systems can be broken down by a demulsifying additive; such agents should be chosen and used with care.

21-42. **Thermal Stability Method of Evaluating Engine Oils and Relation to Piston Ring Sticking.** *Automotive Industries,* v. 92, May 15, '45, pp. 30-32, 102, 104.

New method of evaluating the piston ring sticking tendencies of aircraft engine oils involves the correlation of thermal stability of an oil, and ring sticking conditions.

21-43. **Lubrication.** *Automobile Engineer,* v. 35, April '45, p. 165.

Notes on the use of additives.

21-44. **Bearing Developments.** P. T. Holligan. *Foundry Trade Journal,* v. 75, May 3, '45, pp. 3-9.

Tracing the developments of bearings from the original gun metal bearings. Gun metal; phosphor bronze; the disadvantages of gun metal; alternative specifications; leaded gun metals; lead bronzes; graphitic cast iron shafts; foundry problems with bearing metals; steel shells; copper-lead lining; practical use; crankshaft hardness; sintered copper lead and lead bronze; trimetal.

21-45. **Factors Causing Lubricating Oil Deterioration in Engines.** R. E. Burk, E. C. Hughes, W. E. Scovill, and J. D. Bartleson. *Industrial & Engineering Chemistry* (Analytical Edition), v. 17, May '45, pp. 302-309.

Deterioration of lubricating oil in internal combustion engines due largely to oxidation reactions. These reactions are primarily catalytic at the engine temperatures in question, the catalysts being metals and metal compounds such as iron, copper, lead, and their compounds. Laboratory test procedure for evaluating the service stability of oils in which an attempt was made to develop a set of conditions and catalysts which duplicate those of the present Chevrolet engine test. Degrees of reproducibility and of correlation with engine results are shown in detail. 16 ref.

21-46. **Rotating-Load Bearings.** Arthur F. Underwood. *Automotive Industries,* v. 92, June 1, '45, pp. 26-28, 60, 64.

Concept of operation and a frictionless support.

21-47. **Universal Gear Lubricants.** Paul V. Keyser. *SAE Journal,* v. 53, June '45, pp. 341-344.

There is no laboratory test or combination of tests that will accurately predict the ability of a lubricant to protect gears under all conditions of operation. It will be necessary to define lubricants in terms of simulated service tests. CRC and the Army have developed two service evaluation tests that appear to give, jointly, a good measure of the dual, speed-pressure function.

21-48. **Galling and Seizing.** *Metallurgia,* v. 31, April '45, pp. 315-316.

Study of friction galling and seizing of metal surfaces sliding in contact one with another by the Meehanite Research Institute of America, Inc.

21-49. **Bearing Developments.** P. T. Holligan. *Foundry Trade Journal,* v. 76, May 10, '45, pp. 31-35.

Bearings for cast iron crankshafts; aluminum base metal bearings; tin to copper ratio; emergency properties; overseas practice; silver bearings; use of indium; bearings for railway wagons.

21-50. **Bearing Down on Friction.** Edwin Laird Cady. *Scientific American,* v. 172, June '45, pp. 336, 338, 340.

Certainty of action under varying conditions, plus savings in power, are two of the ways in which antifriction bearings are making for faster and more accurate production in American industry. To gain these great advantages, scrupulous maintenance is needed.

21-51. **Centralized Lubrication Simplifies Press Maintenance Problems.** Harry W. Tompkins. *Modern Industrial Press,* v. 7, May '45, pp. 27-30, 32.

Advantages summarized.

21-52. **Ball Bearing Versatility.** H. F. Williams. *Machine Tool Blue Book,* v. 41, June '45, pp. 231-232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252.

Deals with applications in which balls alone are featured—made not only of steel but several other materials.

21-53. **Lubrication Needs for Machines Indicated by Color Code System.** W. H. Helms. *American Machinist,* v. 89, June 7, '45, pp. 110-112.

Systematic lubrication program preserves the life of equipment. Colored symbols are used to show the various oil and grease requirements.

21-54. **Machine Tool Lubrication.** William H. Oldacre. *Tool Engineer,* v. 14, May '45, pp. 43-45.

Increased production, higher quality, lower costs possible with correct lubrication, starting with machine tool design.

21-55. **Additives Improve Hydraulic Oils.** W. G. Huebler. *American Machinist,* v. 89, June 21, '45, pp. 110-112.

Hydraulic headaches are often caused by conditions beyond the control of the oil supplier or the manufacturer of the machine. Providing the cure before the trouble exists is the function of hydraulic additive agents.

21-56. **The Frictional Properties of Some White Metal Bearing Alloys: The Role of the Matrix and the Hard Particles.** D. Tabor. *Journal of Applied Physics,* v. 16, June '45, pp. 325-337.

Experiments on a typical lead-base bearing alloy which consists of a soft matrix in which are dispersed numerous hard crystallites. Measurements of the friction were made at room temperature and at elevated temperatures for clean and for lubricated surfaces. Comparison with a special alloy consisting of the matrix material alone, showed that the hard particles played no appreciable part in the basic frictional and wear properties of the bearing alloy. Experiments are described on a typical tin-base bearing alloy and a corresponding tin-base "matrix" alloy.

21-57. **Bonded Marine Type Bearings.** C. L. Thompson. *Pig Iron Rough Notes,* no. 99, Spring-Summer, '45, pp. 6-9.

Federated method of bearing bonds. Inside of the bearing is machined on surface and roughed to provide a suitable bonding base, by using a sharp "V" shaped tool on the final cut. No oil or cutting compound is utilized for the boring of the shell. Shell is then removed from the machine and tinned. The machined shell is submerged completely in a boiling solution of alkaline cleaner to remove traces of dirt, grease, and grime, then submerged in a 50-50 hydrochloric acid solution at a temperature between 160 and 180° F. and etched.

21-58. **The Tri-Alloy Bearing.** *Automobile Engineer,* v. 35, May '45, pp. 195-197.

Tri-alloy bearing with a service life of two to three times that of a conventional bearing; composed of 4½ to 5% silver, 35 to 40% lead and the balance copper, with a trace of iron.

21-59. **The Use of Coolants in Grinding Fine Surfaces.** H. J. Wills and H. J. Ingram. *Machinery* (London), v. 66, June 7, '45, pp. 623-626.

Characteristics of ideal coolant for fine grinding; soluble-oil coolants; advantages of filters and settling tanks.

21-60. **Cutting Fluids and Their Use in the Industry.** R. I. Mahan. *Western Machinery & Steel World,* v. 36, June '45, pp. 260-263, 274.

Selection of the type of cutting fluid to be used generally depends upon the work piece, type of operation, and kind of cutting tool used. Kind of cutting tool that is used affects greatly the selection of the cutting fluid.

21-61. **Symposium on Neutralization Number.** American Society for Testing Materials *Bulletin,* no. 134, May '45, pp. 48-57.

Neutralization number from the viewpoint of the industrial engineer; neutralization number from the viewpoint of the turbine engineer; neutralization number from the viewpoint of the automotive engineer; a comparison of the salt method with A.S.T.M. method for determining the acidity of lubricating oils.

21-62. **Causes of Failure in Heavy-Duty Bearings.** L. M. Tichvinsky. *Machine Design,* v. 17, July '45, pp. 115-116, 176.

Discusses types of failures most often encountered in the critically loaded bearings of a diesel, and indicates some preventive measures which, it is hoped, will aid designers in providing maximum bearing life in other types of machines.

21-63. **Relining Lead Alloy Journal Bearings.** E. A. Wolfenden. *Metals & Alloys,* v. 22, July '45, pp. 81-84.

Describes best practices in fluxing, tinning, pouring and cooling the lining metal and other operations to produce the highest possible bond strength between bearing metal and backing in the relining operation.

21-64. **Lubricants in Diamond - Crown Cutting Fluids.** *Industrial Diamond Review,* v. 5, July '45, p. 161.

Tests to determine the effect of lubricating agents in a diamond-drilling bit coolant and cuttings-removal liquid on the drilling speed and bit wear; tests carried out by U. S. Bureau of Mines. Results given in Reports of Investigations 3793.

21-65. **Testing Cutting Oils.** *National Petroleum News,* v. 37, Aug. 1, '45, pp. R614-R616,, R-618, R620, R622.

New procedure of evaluating this specialty product has enabled a large reduction to be made in number of grades manufactured.

21-66. **Carrying Capacity of Bearing Liners of Sintered Iron.** E. Heidebroek. V.D.I. *Zeitschrift,* v. 88, no. 15 and 16, 1944, pp. 205-207. *Engineers' Digest* (American Edition), v. 2, July '45, pp. 321-322.

Sintered iron a favorite metal for bearing liners because of its porosity which makes possible the retention of a certain amount of oil in its innumerable pores by capillary force. Test results show clearly that the field of successful application lies within the range of low speeds with an upper limit of 5 m. per sec. at most. Sintered iron bearings characterized by the fact that such bearings are capable of highly successful long time operation with a low coefficient of friction and without any external oil supply.

21-67. **Investigation of the Isothermal Viscosity of Bearing Alloys.** J. de Lacombe and M. Dannenmuller. *Revue de Metallurgie,* v. 41, no. 3, 1944, pp. 71-82. *Engineers' Digest* (American Edition), v. 2, July '45, pp. 349-352.

Plastic flow of bearing alloys in compression, with particular attention to the time factor. Machine employed for carrying out the tests is of a special design

based upon experiences made in the creep testing of steels at high temperatures. Description of machine and results of tests on lead-base alloys, lead-tin-base alloys, cadmium-base alloys, zinc-base alloys, copper-base alloys, magnesium and aluminum-base alloys.

21-68. **Lubrication of Metal Surfaces by Fatty Acids.** F. P. Bowden, J. N. Gregory and D. Tabor. *Nature,* v. 156, July 28, '45, pp. 97-101.

Effect of chain length; film thickness; effect of temperature; nature of the underlying surfaces; lubricating properties of metal soaps; mechanism of boundary lubrication. 19 ref.

21-69. **Cutting Oils for Machining Metals.** Edwin Laird Cady. *Metals & Alloys,* v. 22, Aug. '45, pp. 431-446.

Types and characteristics; some comparisons; handling and treating; for specific operations; materials, and machinabilities.

21-70. **Cutting Oil Comes Back.** Edwin Laird Cady. *Scientific American,* v. 173, Sept. '45, pp. 151-152, 154.

Plain water, water-and-oil mixtures, and straight oils all have helped to speed machining processes and make them more accurate. Every time tool material changes seemed to point to the possibility of eliminating cutting oils from the machine, it was found that better work could be accomplished by keeping them on the job.

21-71. **Refrigeration of Coolants for Machine Tools.** B. S. Williams. *Machinery,* (London), v. 67, July 19, '45, pp. 72-73.

By cooling cutting oil to approximately 70° F. cutting time per cylinder reduced from 1 hr. and 50 min. to 1 hr. Damage to drills materially reduced and less machine time was lost. Cites advantage.

21-72. **Bearing Development Up to Date.** Henry W. Luetkemeyer. *National Petroleum News,* v. 37, Sept. 5, '45, pp. R-718, R-720, R-722, R-724.

In general, bearing life is characterized by three qualities: Resistance to fatigue, surface action, corrosion or wear. Roughly classifies different types of service in terms of hours of life.

21-73. **Functional Testing of Lubricating Greases.** J. F. MacPhearson. *General Electric Review,* v. 48, Sept. '45, pp. 42-47.

Provides a realistic means of evaluating bearing greases. How applied with respect to aircraft generators.

21-74. **Silver Bearings.** E. B. Etchells and A. F. Underwood. *SAE Journal,* v. 53, Sept. '45, pp. 497-503.

Describes some of the salient factors affecting the process and performance of silver bearings as related to present-day applications; first tests; faults of early silver bearings; improvements in running characteristics; performance characteristics; fatigue; score resistance and embeddability; corrosion resistance; functional relationship of materials. When properly prepared and bonded to the bearing backing its resistance to fatigue is greater than that of any other known metal.

21-75. **Magnetic Coolant Separators.** *Steel,* v. 117, Sept. 17, '45, pp. 130, 163.

Metal and abrasive particles carried by coolants are quickly removed by this automatic continuous-flow unit, eliminating danger of damage to precision-finished surfaces.

21-76. **Lubrication in the Drawing of Metals.** Samuel Spring. *Steel,* v. 117, Oct. 8, '45, pp. 120, 122, 125, 180, 182.

Physical methods of testing drawing lubricants. Boundary and extreme pressure lubricants; methods of testing boundary lubricants; measuring extreme pressure lubrication characteristics; methods of testing extreme pressure lubricants. 39 ref.

21-77. **Assembly of Bearings by Sampling Principle.** *Iron Age,* v. 156, Oct. 11, '45, p. 53.

New method consists of the operation of taking one inner ring from a group of about ten such rings previously selected by measurement, and matching its fit with an outer ring belonging to a selected group of outers in the same dimensional range variation as the inners.

21-78. **The Function of Grinding Fluids.** W. H. O. *Machinery* (London), v. 67, Aug. 23, '45, p. 219.

Brief review of grinding fluids; chip formation in grinding.

21-79. **Improved Babbitting Methods.** George R. Park. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 48-49.

Using a novel combination of equipment, modern production methods have been applied to babbitting, resulting in greater safety and economy.

21-80. **Cutting Fluid Applications.** Albert W. McCalmont. *Tool Engineer,* v. 15, Oct. '45, pp. 26-27.

Right cutting fluid, properly applied, prolongs tool life and improves surface quality.

21-81. **Simplified Lubrication.** James G. O'Neill. *Steel,* v. 117, Oct. 1, '45, pp. 118, 124.

Charts for lubrication of steel mill and metal-working equipment are designed to reduce inventories of lubricants and check errors in applications.

21-82. **Storage and Handling of Lubricants.** L. E. Lovitt. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 52-53, 56.

Adequate storage and distribution of lubricants is essential to a well developed lubrication program. Cleanliness is essential.

21-83. **Organization of a Lubrication Department.** C. A. Bailey. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 54-56.

Results from a lubrication department are directly proportional to effort expended. Close cooperation between maintenance and lubrication departments is essential.

21-84. **Shaft Currents May Cause Bearing Failure.** D. B. Hoover. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 72-74, 78.

Excessive bearing wear and failures may result from stray currents induced in the shaft of an a. c. or d. c. ma-

chine. Such currents are easily eliminated or shunted away from the bearings.

21-85. **Lubrication in the Drawing of Metals.** Samuel Spring. *Steel,* v. 117, Oct. 15, '45, pp. 124, 126, 128, 130, 133, 134, 180.

Specific methods of testing drawing lubricants. 9 ref.

21-86. **Silver-Thallium Anti-Friction Alloys.** F. R. Hensel. *Metals Technology,* v. 12, Oct. '45, T.P. 1930, 14 pp.

Microstructure and physical properties of cast silver-thallium alloys containing up to 10% thallium were investigated. Homogenizing treatments of electroplated alloys eliminate internal stresses, preferred orientation and non-uniform grain size. The diffusion of electroplated thallium into silver is improved by indium. Alloy layers containing 2 to 3% thallium, of a depth of 0.003 in., are produced by carrying out the diffusion process at 600° C. for 6 to 12 hr. in hydrogen. Amsler seizure tests indicate that a 2% silver-thallium alloy has optimum anti-friction properties. Underwood corrosion test has established extremely low rates of corrosion of silver-thallium alloys as compared with silver-lead or copper-lead alloys. 11 ref.

21-87. **Physical Properties of Sprayed Metals.** A. P. Shepard. *Welding Journal,* v. 24, Oct. '45, pp. 937-938.

Specific gravity as a measure of porosity in bearings. Standard procedure for determination; tables of results on various sprayed metals.

21-88. **A New Bearing for Machine-Tool Spindles.** P. E. Burger. *Machinery* (London), v. 67, Sept. 27, '45, pp. 350-351.

Two types of bearings, one in which clearance is self-adjusted by external hydraulic pressure, other is adaptation of Mitchell principle. A definite initial clearance is provided between each pad surface and its shaft in order to allow an oil-film to form.

21-89. **The Determination of Metals in Lubricating Oils.** Louis Lykken, K. R. Fitzsimmons, S. A. Tibbetts and Garrard Wyld. *Petroleum Refiner,* v. 24, Oct. '45, pp. 133-142.

Detailed procedures are given for the determination of lead, copper, cadmium, barium, tin, silica, zinc, iron, aluminum, calcium, magnesium and alkali metals in new or used lubricating oils without interference from other elements such as sulphur, phosphorus and chlorine.

21-90. **Bearing Lubrication Progress Paced by Cooperative Research.** A. F. Brewer. *Aero Digest,* v. 51, Oct. 15, '45, pp. 60-61, 114, 118, 120.

Oxidation resistance; water resistance test; coefficient of friction; oil spray and mist lubrication; controlling quantity of grease.

21-91. **Heating and Failure of Bearings Due to Little Appreciated Causes.** D. B. Hoover. *Water Works and Sewerage,* v. 92, Oct. '45, pp. 297-299.

Detection of bearing currents; corectives; measure of shaft current the index; value of clean oil in bearings; roller or ball bearings most susceptible to current attack.

21-92. **Centralized System.** *Automotive Industries,* v. 93, Oct. 15, '45, p. 25.

Facilitates storage and distribution of lubricating oils and cutting fluids.

21-93. **Inhibitive Polar Type Rust Preventives—Synthesis and Use.** James E. Shields. *Corrosion and Material Protection,* v. 2, Nov. '45, pp. 6-10, 18.

Comparison of results obtained from measurements made with the lubarometer has given much insight into "mysteries" of lubrication and has been helpful in showing how effectively polar molecules improve lubricating properties of non-polar lubricating oils.

21-94. **Honan-Crane Oil Clarifiers Continuously Reclaim Coolant.** *American Machinist,* v. 89, Nov. 22, '45, pp. 162, 164.

Removes chips, abrasives and other solid contamination from oils and coolants in machine-tool operations.

21-95. **New Bearing Alloy Conserves Tin.** *Iron Age,* v. 156, Nov. 29, '45, pp. 64-65.

Investigation outlines development of a bearing alloy low in tin, as compared to the 80-10-10 alloy. Physical properties, wear resistance, and metallographic comparisons are made.

21-96. **Electronic Air Cleaners.** Francis A. Westbrook. *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 285-286, 288, 290, 292, 294.

Electronic air cleaners are installed to recover oil mists from coolants, to provide better housekeeping and working conditions and to salvage coolants.

21-97. **Control of Dust and Coolant in Surface Grinding.** H. J. Chamberland. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 520-523.

Drawing dust-laden air at the rate of 200 to 250 c.f.p.m.; grinder coolant of the highest quality followed development of specially-processed soluble oil.

21-98. **High-Speed Bearings Made from Cemented Carbide.** *Machinery,* v. 52, Nov. '45, 148.

Carbide-to-carbide bearings, subjected to the same service as standard steel ball bearings, have been in operation for more than two years, with two 8-hr. shifts per day. The measurable wear is said to be only 0.000004 in.

SECTION XXII

WELDING AND JOINING

Brazing; Flame Cutting; Riveting

22-1. **Welding Sectionally Cast Stern Frames.** *Iron Age,* v. 154, Dec. 28, '44, pp. 52-54.

Thermit welding on Victory ships; stern frames and bow sections on these ships furnished in sections. Bow stems welded; sections then placed on the welding slab and the ends burned to the proper length.

22-2. **Automatic Regulated Flux Supply Improves Silver Soldering Production Efficiency.** *Iron Age,* v. 154, Dec. 28, '44, p. 55.

New flux supply technique for silver soldering has practically eliminated the principal non-productive finishing operations. Process results in automatic supply of flux to the joint in the correct amount and at a uniform rate.

22-3. **Arc Welding Safety Factors.** R. F. Wyer. *Aero Digest,* v. 47, Dec. 15, '44, pp. 114-116, 229.

Discusses safety factors from the electrical point of view and shows definite ways by which the hazard can be almost completely overcome.

22-4. **Beryllium Copper Bellows with Leakproof Construction.** A. E. Ross. *Industry & Welding,* v. 17, Dec. '44, pp. 48-49, 51.

Leak-proof bellows construction depends on silver solder process.

22-5. **Blazing the Trail with Welded Construction—III.** *Industry & Welding,* v. 17, Dec. '44, pp. 39, 42-44, 47.

Extension arm assembly; mounting bracket assembly.

22-6. **Flash Welds.** *Automobile Engineer,* v. 34, Dec. '44, p. 534.

The quality of resistance in high-tensile steels.

22-7. **Arc Welded Cutting Alloys.** E. C. Rollason and P. Harris. *Metallurgia,* v. 31, Nov. '44, pp. 3-6.

Alloys of high hardness have many applications when deposited on tougher materials; they are applied where high hardness, high polish and low coefficient of friction and high abrasive resistance are required. Attention is especially directed to their application for cutting purposes and to their deposition by the arc welding method.

22-8. **The Quality of Resistance Flash Welds of High Tensile Steels.** F. Bollenrath and A. Cornelius. *Metallurgia,* v. 31, Nov. '44, p. 46.

Experiments were carried out with two chromium-vanadium alloy steels, one of which also contained molybdenum. Flash butt welds were carried out on an A.E.G. resistance welding machine employing a specific upset pressure of 5 kg. per sq. mm. over a travel of 4 to 7 mm. (*Luftfahrtforschung,* v. 21, no. 1, Feb. 28, '44, pp. 17-28.)

22-9. **Production in the Fabricating Shop.** F. Koenigsberger. *Welding,* v. 12, Dec. '44, pp. 532-539.

How to apply to the fabricating shop, in the case of high class welded products, machine structures, etc. Methods of inspection whose value for technical and economical efficiency in the machine and fitting shop has been established.

22-10. **A New Dressing Tool.** W. S. Simmie. *Welding,* v. 12, Dec. '44, pp. 540-541.

For the maintenance of electrode tips for spot welding machines.

22-11. **Naval Construction.** Stanley V. Goodall. *Welding,* v. 12, Dec. '44, pp. 542-546.

Application of welding.

22-12. **Steel Framed Houses.** *Welding,* v. 12, Dec. '44, pp. 547-550.

Use of spot welding in their fabrication.

22-13. **"Two-Tone" Arc Welding.** J. A. Cunningham. *Welding,* v. 12, Dec. '44, pp. 551-552.

Technique for rebuilding of worn surfaces. (Reprinted from *Iron Age.*)

22-14. **A Landing Has Been Made.** *Welding,* v. 12, Dec. '44, pp. 553-556.

Construction of invasion craft.

22-15. **Design of Welded Structures, I.** J. Corston MacKain. *Welding,* v. 12, Dec. '44, pp. 557-563.

Welding details of work on a factory building which was partly welded and partly riveted.

22-16. **Factors Controlling the Weldability of Steel.** L. Reeve. *Welding,* v. 12, Dec. '44, pp. 573-579.

American work on weldability of low alloy steels; Jominy tests; the bend tests; discussion of Doan and Stout's procedure; mechanically satisfactory joints; what are soft electrodes. 22 ref.

22-17. **Welding.** Frank J. Oliver. *Iron Age,* v. 155, Jan. 4, '45, pp. 83-85, 174, 176, 178, 180, 182.

Methods have been developed for welding the hardenable steels hitherto considered unweldable. Some answers have been found as to the behavior of metals under triaxial stress and metallurgical deterioration that takes place as a result of arc welding.

22-18. **Arc Welding Metal-Cutting Tools to Save High-Speed Steel.** *Machinery,* v. 51, Jan. '45, pp. 178-181.

Methods developed for the maintenance of high-speed steel cutting tools and the conservation of tungsten used in their manufacture. Abstract of an article entered in the James F. Lincoln Arc Welding Foundation Award Program by H. W. Rushmer.

22-19. **Deep Fillet Welding.** R. V. Anderson. *Steel,* v. 116, Jan. 8, '45, pp. 86-88, 128.

Increases welding footage two to three-fold; affords savings in electrode consumption of about one-third; employs predetermined angle, travel rate, and amperage.

22-20. **Destructive Effect Indicates Caution in Use of High-Temperature Solders for Fine Copper Wire.** *Steel,* v. 116, Jan. 8, '45, pp. 102, 105, 133-134.

While conducting tests that resulted in the finding of a new method for clean-stripping Formex type insulation from fine wire (sizes No. 36-44), Fairchild engineers explored this phenomenon, and worked out a preventive.

22-21. **Laminating Steel and Cupronickel.** J. V. Kielb. *Steel,* v. 116, Jan. 8, '45, pp. 114, 116, 118.

Process for super-cladding header plates for motor-generator sets and similar applications where vibration puts laminated assemblies to severe test accomplished by combining single mild steel plate with two lesser thicknesses of cupronickel. Copper binder and hydrogen brazing make good bond.

22-22. **Joint Design for Silver-Brazing Non-Ferrous Metals.** *Oxy-Acetylene Tips,* v. 24, Jan. '45, pp. 5-8.

Suggestions regarding the design of joints that are to be made by silver-brazing. Joints in copper; thin film; tank and container heads; operating temperatures.

22-23. **How to Make Cutting Machine Templets.** *Oxy-Acetylene Tips,* v. 24, Jan. '45, pp. 9-13.

Templet base material; principles of templet layout; attaching the templet strip; care of templets.

22-24. **Thermit Welding in Heavy Fabrication.** Kenneth Rose. *Metals & Alloys,* v. 20, Dec. '44, pp. 1620-1624.

Nature and utility of thermit welding; describes its engineering applications in the heavy-fabrication field.

22-25. **Welding Fabrication.** J. A. Dorratt. *Steel Processing,* v. 30, Dec. '44, pp. 785-787, 805.

Guillotine for straight cutting; flame-cutting machine is used for the profile work. Advantage of these methods lies in the reduction in the amount of plate distortion resulting in cutting. Machines available in a variety of forms and suitable for repetition work from templates or for tracing individual shapes from a drawing. Multi-jet machines cut the contours but also the plate edge preparation at the same time. (Abstract of paper presented to the Institute of Marine Engineers.)

22-26. **Wire Stitched Lap Joints in Aluminum Alloy Sheet.** MacDonald Sill. *Product Engineering,* v. 16, Jan. '45, pp. 38-39.

Zinc-coated steel wire staple joints in aluminum sheet give satisfactory results in salt spray test for corrosion resistance, and in pull strength and vibration tests. Long service records also show wire stitching is suitable for many joints.

22-27. **Screws with Recessed Heads Test Stronger than Slotted Type.** T. R. Rieben and C. J. Spengler. *Product Engineering,* v. 16, Jan. '45, pp. 46-48.

An investigation to determine why countersunk headscrews when used in lap joints fail at less than calculated load. Causes of failures are analyzed and a method of determining the allowable load developed. Slotted head screws are found to fail at lower loads than recessed head screws, the position of the slot in relation to the direction of load having considerable effect on the load-carrying ability of slotted head screws.

22-28. **Metlbond Adhesive for Metals.** G. G. Havens and H. R. Jenks. *Iron Age,* v. 155, Jan. 18, '45, pp. 62-64, 136.

By combining two adhesives, one having a synthetic rubber base and the other a plastic base, Consolidated Vultee developed a high strength bonding agent for metals and non-metals that can be cured under low pressure in inexpensive jigs.

22-29. **Special Cutting Set-Up Aids War Production.** H. R. Gettys. *Industry and Welding,* v. 18, Jan. '45, pp. 37-39.

Adroit use of ingenious equipment to speed a cutting operation.

22-30. **Blazing the Trail with Welded Construction.** G. S. Storatz. *Industry and Welding,* v. 18, Jan. '45, pp. 40-41, 69.

Outlines type of construction by which it is possible to get a cylinder which has the inside bore held to a high degree of precision even though some of welding is done after finish machining.

22-31. **Welding for Glass Lined Construction.** W. G. Degray. *Industry and Welding,* v. 18, Jan. '45, pp. 44-46, 52, 54, 56-60, 62-63.

In the fabrication of such glass-lined equipment it is very necessary that the weld deposition be of the highest quality regardless of the welding process used. To attain this quality, it is advantageous to use any technique or process that will result in a deposition that is free of porosity, inclusions, gas pockets, coldshuts, or any other imperfections.

22-32. **The Effect of Plate Width on Fabrication Costs of Boilers, Tanks and Pressure Vessels.** W. G. Theisinger. *Industry and Welding,* v. 18, Jan. '45, pp. 48-49, 89-94.

The designer's problem is to find that combination of width extras, and fabricating operations, which produces the lowest cost of construction.

22-33. **Controlled Quality Workmanship.** Robert Burnett. *Industry and Welding,* v. 18, Jan. '45, pp. 64-68.

Operational data for the welder for improved quality work.

22-34. **Spot Welding Aluminum.** *Industry and Welding,* v. 18, Jan. '45, p. 73.
Thorough cleaning is the only way yet found to prevent undue tip wear, excessive pick-up of metal on the tip, lack of uniform weld strength, and the occurrence of cracks in the weld buttons.

22-35. **Arc-Welded Engine Mountings.** *Aircraft Production,* v. 7, Jan. '45, pp. 27-31.
Production of Avro-Lancaster sub-frames.

22-36. **Trends in Design of Weldments.** Edward J. Charlton. *Machine Design,* v. 17, Jan. '45, pp. 135-142, 192.
Incorporating castings in weldments; operating efficiency increased; utilizing rolled steel; effects of battle action on weldments; basic component is hot-rolled plate; utilizing drop-forged components.

22-37. **1944—Production Reaches Peak.** T. B. Jefferson. *Welding Engineer,* v. 30, Jan. '45, pp. 35-37.
Though the production of war material has not slumped, a leveling off from the peaks of the past year is apparent. The welding industry continues to make progress in research. Among the most promising of the new developments are multiarc welding, electronically controlled flame-cutting and storage-battery resistance welding.

22-38. **Fabrication Cost vs. Width.** W. G. Theisinger. *Welding Engineer,* v. 30, Jan. '45, pp. 40-43, 64.
To build the shell of a pressure vessel, answer to which is more economical—a one-piece fabrication of a wide plate or a two-piece fabrication of narrower plates.

22-39. **Welded Railroad Rails.** *Welding Engineer,* v. 30, Jan. '45, pp. 44-47.
Continuous rail offers a big market for welding in the postwar world. Flash-welded rail and equipment that is needed to produce it.

22-40. **Welding With Aluminum Bronze.** Roy Norton. *Welding Engineer,* v. 30, Jan. '45, pp. 48-51.
Aluminum-bronze electrode has an enormous capacity for tackling tough jobs. It is used in both maintenance work and original fabrication, for both welding and hard facing.

22-41. **Bucking the Buckling.** Arthur H. Brown, *Welding Engineer,* v. 30, Jan. '45, pp. 52-53.
Can be done successfully by keeping in mind the fundamentals: (1) Expansion and contraction will occur wherever heat is applied to metal; (2) there is also the likelihood of distortion or warpage if the heated metal is restrained from its normal movement.

22-42. **Robot Bombs Made by Welding.** T. B. Jefferson. *Welding Engineer,* v. 30, Jan. '45, pp. 54, 56, 58.
Ninety days after fragments of the V-1 flying bomb

had been salvaged in England, U. S. engineers had produced a complete working model. Technical facts uncovered regarding Hitler's no-longer-secret weapon.

22-43. **Methods of Joining Aluminum-Alloy Products.** E. C. Hartmann, G. O. Hoglund and M. A. Miller. American Society of Mechanical Engineers *Transactions,* v. 67, Jan. '45, pp. 1-21.

Clarifies procedures that have become established for making joints in these alloys. Discussion includes the common practices of riveting, welding, brazing, soldering, and a promising new possibility, resin-bonding.

22-44. **Flash Welding SAE 4130 Steel Tubing.** Walter Pestrak and W. W. Ackerman. *Iron Age,* v. 155, Jan. 25, '45, pp. 46-49.

SAE 4130, with NE 8630, has distinguishing characteristics which make it particularly desirable as an aircraft steel, such as excellent strength-weight ratio, good weldability and high tensile strength with good impact resistance. Practical considerations relating to the flash welding of this material presented.

22-45. **Optimum Plate Width Determination in Fabricating Pressure Vessels.** W. G. Theisinger. *Iron Age,* v. 155, Jan. 25, '45, pp. 56-59, 149.

Method applicable to tanks, boilers and pressure vessels of dissimilar shapes presented which enables the fabricator to make a quick comparison of the cost of welding vs. plate width extras.

22-46. **Jigs and Fixtures for Welding.** A. N. Kugler. *Welding Journal,* v. 24, Jan. '45, pp. 5-12.

Jigs and fixtures should be as simple as is consistent with the requirements of the problem. They should be rugged and substantial without being excessively heavy. They must be strong enough to hold the component parts in the desired positions not only when cold but also when heat of welding is applied. (Presented at the Twenty-Fifth Annual Meeting, American Welding Society, Cleveland, Oct. 16 to 19, '44.)

22-47. **New Silver Soldering Technique Improves Production.** C. A. Medsker. *Welding Journal,* v. 24, Jan. '45, pp. 22-23.

Development of a new technique for the use of silver solder and other low melting point alloys in production has practically eliminated tne principal non-productive finishing operations that have been common-place steps of procedure in numerous plants. The essence of the improvement is the automatic supply of flux to the joint in the correct amount and at a uniform rate.

22-48. **Recent Applications of Oxy-Acetylene Processes in Steel Foundries.** G. E. Bellew. *Welding Journal,* v. 24, Jan. '45, pp. 25-35.

Machine cutting; scarfing; gouging; flame descaling; flame heating.

22-49. **Welding of Locomotives for Main Line Operation.** *Welding Journal,* v. 24, Jan. '45, pp. 45-50.

Electric welding proved itself superior to other

methods of construction in many industries and now it is rapidly earning a good acceptance in the railroad industry for one of the most important jobs of all—rolling stock. (Presented at the Twenty-Fifth Annual meeting, American Welding Society, Cleveland, Oct. 16-19, '44.)

22-50. **Normalizing of Welds in Carbon-Molybdenum Steel Pipe by 60-Cycle Induction Heating.** D. H. Corey and I. A. Rohrig. *Welding Journal,* v. 24, Jan. '45, pp. 1s-6s.

Presents the results of tests carried out on a 14-in. O.D. 0.937-in. wall thickness carbon-molybdenum pipe on which local normalizing was accomplished with 60-cycle stress-relieving equipment, and includes the results of a metallographic examination showing the microstructure of samples cut from various locations in the pipe. (Presented at the Twenty-Fifth Annual Meeting, American Welding Society, Cleveland, Oct. 16-19, '44.)

22-51. **Flash-Butt Welding — Welding Technique and Variables in Welding Low-Alloy Steels.** J. J. Riley. *Welding Journal,* v. 24, Jan. '45, pp. 12s-24s.

Flashing action; nature of the flashing action; energy input during the flashing action; electrical consideration in the flashing action; the flashing action as observed from measurements of electrical quantities; secondary voltage and load voltage; procedure for setting variables that control the flashing action; the nature of the upsetting action; platen force versus upset velocity; upset velocity; measurement of upset variables; upset current; post-heating current; application of flash-butt welding. 4 ref.

22-52. **Flash Welding of Alloy Steels — Physical and Metallurgical Characteristics.** J. C. Barrett. *Welding Journal,* v. 24, Jan. '45, pp. 25s-44s.

Alloy steels, with their higher hardenability and their more complex nature, provide a host of new problems to the welding engineer, particularly since alloy steel flash welded parts are often subjected to high stresses in service. Some of the problems which arise in the flash welding of alloy steels are considered and an attempt is made toward the solution of the problems.

22-53. **Problems in Spot Welding of Heavy Mild Steel Plate.** F. R. Hensel and E. F. Holt. *Welding Journal,* v. 24, Jan. '45, pp. 46s-57s.

Investigation carried out to determine certain weld characteristics with respect to welding conditions and electrode design. Conventional a.c. resistance welding equipment was employed in all tests. 9 ref.

22-54. **Welding Developments in 1944.** Guy Bartlett. *Steel Processing,* v. 31, Jan. '45, pp. 29-30.

Gas-shielded arc welding; electrodes; resistance welding.

22-55. **New Silver Soldering Technique Improves Production.** C. A. Medsker. *Steel Processing,* v. 31, Jan. '45, pp. 34, 38.

New technique for the use of silver solder and other low melting point alloys in production has practically eliminated the principal non-productive finishing operations. Automatic supply of flux to the joint in the correct amount and at a uniform rate.

22-56. **Fabrication of All-Welded Steel Equipment and Its Application to the Ceramic Industry.** E. A. Hawk. American Ceramic Society *Bulletin,* v. 24, Jan. 15, '45, pp. 12-15.

Progress of welded construction reviewed and some of the difficulties encountered discussed. Ways and means of eliminating most of the problems affecting welded friction and anti-friction bearings in line also discussed. Automatic equipment for cutting shapes from steel plates, such as the pantograph machine, described.

22-57. **Silver Alloy Brazing with Induction Heating.** A. M. Setapen. Electrochemical Society Preprint 86-25, Oct. '44, 21 pp.

With low temperature (700° C.) silver brazing alloys there are definite advantages in using induction heating; the operations are extremely simple and uniform results are obtained; comparatively small amounts of brazing alloy are required. The over-all cost is low. High frequency induction heating results in very rapid brazing and in confining the heat to a minimum area and, therefore, minimum annealing, minimum distortion, and minimum surface oxidation of the metals being joined.

22-58. **Parallel Connection of Welders Provides Heavier Currents for Automatic Welding.** I. B. Yates. *Machinery,* v. 51, Feb. '45, pp. 153-155.

Use of continuous electric welding by means of automatic welding heads, requiring current supply in the 700 to 2000 ampere range, has raised the question of whether smaller capacity welding generators or transformers can economically be connected in parallel to provide these heavy currents, and if so, how should the connections be made.

22-59. **Improved Arc-Welded Construction for Steel-Plate Forming Dies.** *Machinery,* v. 51, Feb. '45, pp. 170-172.

Method of constructing forming dies for heavy steel plate by arc welding and the use of concrete between reinforcing beams (abstract of an article entered in the James F. Lincoln Arc Welding Foundation Annual Program by Walter E. Klauberg).

22-60. **Copper-Brazing of Steel Assemblies.** J. D. Jevons. *Canadian Metals & Metallurgical Industries,* v. 8, Jan. '45, pp. 24-26.

Methods, equipment, inspection, joint strength and applications.

22-61. **Effect of Time of Storage on Ductility of Welded Test Specimens.** Clarence E. Jackson and George G. Luther. *Metals Technology,* v. 12, Jan. '45, T.P. 1772, 8 pp.

Methods considered: Those that measure directly the effect of welding on the ductility of a steel, and those that observe the change in some property, such as the hardness of the heat-affected zone, and assume a direct correlation between this change and the resultant ductility. 3 ref.

22-62. **Trends in the Use of Welded Machinery Parts.** Edward J. Charlton. *Mechanical Engineering,* v. 67, Feb. '45, pp. 109-118, 129.

Discussion limited to components fabricated from low carbon, hot rolled steel and its related alloys. Reasons for trends in use are comparative first cost, predictability, strength characteristics, need for greater rigidity, weight reduction, wearability, operating efficiency, and natural adaptability.

22-63. **The Degree of the Heat Efficiency in Different Methods of Industrial Welding.** H. Koch. *VDI Zeitschrift,* v. 88, no. 15-16, April 15, '44, p. 209.

The efficiency of heat is determined for each individual welding method. A comparison of heat efficiency of several welding methods is made by the use of plotted curves.

22-64. **Acid-Resisting Steels—II.** *Chemical Age,* v. 52, Jan. 6, '45, pp. 15-16.

Welding of acid-resisting Cr-Ni steels and Cr-Mn steels.

22-65. **New Miniature Electric Arc Welding Appliances.** *Luftwissen,* v. 10, July '43, p. 202. *Welding Literature Review,* v. 6, Feb. '44, p. 3.

Miniature welding appliances brought out by Siemens and Halske intended to replace soldering previously employed in instrument manufacture. Leads to a considerable economy in tin, and work is speeded up since the rather complicated cleaning of the joint, which is essential in soldering, is much simplified.

22-66. **Shipyard Welding.** H. F. Bibby. *Metrop-Vickers Gazette,* v. 20, Oct. '43, pp. 208-225. *Welding Literature Review,* v. 6, Feb. '44, pp. 4, 5.

Before arc welding can be universally welcomed questions on the technique must be answered and doubts existing on certain points cleared up. Some of these questions are: (1) The relative merits and demerits of a.c. and d.c. welding; (2) the relative merits of single and multi-operator sets; (3) the relative costs of different types of equipment; (4) the plant and accessories required for building a 10,000-ton ship; and (5) the effect of the welding load on the supply.

22-67. **Low-Temperature Brazing With Silver Alloys: Technique for Economical Production and High-Duty Product.** A. J. T. Eyles. *Mechanical World,* v. 114, Dec. 3, '43, pp. 642-644. *Welding Literature Review,* v. 6, Feb. '44, p. 11.

Low-grade brazing alloys cost less per joint, but this is offset by the high temperatures required to melt them. By taking proper care in the design and fitting

of a joint, such a small amount of the silver alloy is needed that the saving in time and fuel offsets the higher cost of a more expensive alloy with lower melting point.

22-68. **Rightward or Leftward Welding Technique.** W. Heiz. *Schweiz. Tech. Zeitschrift,* no. 23 and 24, '42, pp. 326-333. (Translated in *Sheet Metal Industries,* v. 18, Oct. '43, pp. 1801-1802, 1804; Nov., pp. 1983-1984, 1986.) *Welding Literature Review,* v. 6, Feb. '44, p. 16.

Rightward (or backward) and leftward (or forward) techniques in gas welding and their fields of application.

22-69. **Spot Welding in the Light Metal Industries.** F. Helbing. *Schweiz-Tech. Zeitschrift,* no. 26, '42, pp. 373-378. (Translated in *Sheet Metal Industries,* v. 19, Jan. '44, pp. 147-150, 152.) *Welding Literature Review,* v. 6, Feb. '44, p. 24.

Development of light alloy spot welding and gives a list of suitable materials. Preliminary surface cleaning of the sheet and suggests suitable methods of preassembly before welding.

22-70. **Arc Weld Surfacing.** W. I. Miskoe. *Modern Engineer,* v. 17, Sept. '43, pp. 197-201. *Welding Literature Review,* v. 6, Feb. '44, p. 33.

Arc weld surfacing is building up of metal surfaces with deposits similar to the parent metal, as well as with alloys of all types, the deposit of which is designed to produce a result which is superior under service conditions to that of the parent metal. Choice of proper electrode.

22-71. **Spot Welding of Aluminum Alloys in Aircraft Construction.** A. V. Zeerleder. *Inter-Avia,* Aug. 9, '43, pp. 1-7. *Welding Literature Review,* v. 6, Feb. '44, pp. 44, 45.

Test figures show that spot welds of high and consistent strength in aluminum alloys can be achieved, provided the welding machine is controlled properly. Average shearing strength in kg. per spot given.

22-72. **The Welding of a Cylindrical Bulk Fuel Tank.** R. G. Colvin. *New Zealand Institute of Welding,* Feb. '43, pp. 6-15. *Welding Literature Review,* v. 6, Feb. '44, p. 63.

Fabrication and erection of a cylindrical fixed cone roof bulk fuel tank from the point of view of the welder.

22-73. **Emergency Railway Bridges Made by Unit Construction.** *Steel,* v. 116, Feb. 12, '45, p. 92.

Drift pins and bolts used in assembling demountable spans featuring interchangeable members.

22-74. **Helix-Type Manifolds.** *Steel,* v. 116, Feb. 12, '45, pp. 96-97, 102.

For supercharged diesel engines are fabricated by electric welding.

22-75. **Welded Joint Design in a Die Cast Assembly.** Jerome R. Peskin. *Die Casting,* v. 3, Feb. '45, pp. 21-22, 24.

Assembly of the Army M-10 range finder was greatly simplified by the development of a welding procedure whereby die castings could be satisfactorily joined to a section of aluminum tubing. This previously had never been done—and is a method that may well be studied by engineers for many products now going "on the boards."

22-76. **Spot Weld Characteristics of Aged 24S Aluminum.** M. L. Ochieano. *Product Engineering*, v. 16, Feb. '45, pp. 90-92.

Quality of spot welds in artificially aged 24S aluminum, conventional methods employed in producing them, and methods of investigating strength are described to show that satisfactory spot welds can readily be produced.

22-77. **Causes and Prevention of Defects in Welding.** Frederick S. Dever. *Product Engineering*, v. 16, Feb. '45, pp. 121-124.

Common defects encountered in arc welding, gas welding, atomic hydrogen welding, and spot welding are described. Proper technique and procedures to insure good welds are suggested to show that defective welding can be prevented.

22-78. **Forging on a Spot Welder.** G. W. Birdsall. *Steel*, v. 116, Feb. 19, '45, pp. 106-107, 146, 148, 151, 152.

Newly developed resistance welding systems with variable pressure and current cycles under precise automatic control greatly extend range of operations that can be handled. Unusual forging and welding jobs illustrate possibilities.

22-79. **Trends in the Use of Welded Machinery Parts.** Edward J. Charlton. *Steel*, v. 116, Feb. 19, '45, pp. 112-114, 116, 118, 160, 162-163.

Judging from the important place welded construction has already assumed in fabrication of machinery parts, the author predicts further extended growth and analyzes the underlying factors responsible in this report presented before the A.S.M.E.

22-80. **The Welding of Process Piping.** Arthur N. Kugler. *Heating and Ventilating*, v. 42, Feb. '45, pp. 57-62, 123.

Discusses pipe metals. Chart enumerating some of the more commonly encountered piping materials, and methods to follow when joining one metal to another.

22-81. **Welding and Cutting in Steel Plant Maintenance.** S. D. Baumer. *Iron and Steel Engineer*, v. 22, Feb. '45, pp. 80-88.

Through the ingenious use of welding and cutting, maintenance men have been able to overcome shortages and shorten delays, thus keeping production at a maximum; typical examples set forth here also show attractive economies.

22-82. **The Inclination of Welds to the Direction of Stress and Its Influence on Tensile Strength.** H. Zschokke and R. Montandon. *Brown Boveri Review*, v. 31, June '44, pp. 187-196.

When computing welds it is common practice to assume a higher point efficiency along the weld than perpendicular to it. Consequently, inclination of the weld in the direction of stress should bring about an increase in load, and this assumption has led to some firms adopting spiral welds in pipe-line and boiler construction. Tests on tensile bars and model boilers, however, have now shown that it is only with relatively low joint efficiencies and very small angles between the axis of the weld and the principal direction of stress that any real increase in load can be achieved.

22-83. **Pressure-Welded Pipe Line.** Elton Sterrett. *Welding Engineer,* v. 30, Feb. '45, pp. 37-39.

Designed primarily to weld railroad rails, the oxy-acetylene pressure welding process has been extended successfully to the construction of natural-gas pipe lines of larger diameter. Article gives details.

22-84. **Training QM Weldors.** Charles B. Dunham. *Welding Engineer,* v. 30, Feb. '45, pp. 40-41.

G. I.'s who attend the blacksmith and welding school of the Army Service Forces Training Center, Camp Lee, Va., learn how to weld by using the most modern equipment.

22-85. **Welding Canada's New Frigates.** Donn Boring. *Welding Engineer,* v. 30, Feb. '45, pp. 42-44.

Despite British influence favoring traditional riveted construction, Canadian shipyards are turning more and more to welding. The trend is especially noticeable in the case of the Frigate—an old name for a new ship.

22-86. **Emergency in the Lead District.** R. A. Brady. *Welding Engineer,* v. 30, Feb. '45, p. 45.

When a wire cable cuts new grooves in a hoist sheave, what can be done to put it back in the old channel? Answer: Use arc welding.

22-87. **Arc-Welded Power Trucks.** C. E. Cochran. *Welding Engineer,* v. 30, Feb. '45, pp. 46-48.

To perform satisfactorily the various jobs of lifting, hauling, stacking, industrial lift trucks must combine mobility of a destroyer with a battleship's stamina. Welding enables them to stand up under rugged service.

22-88. **Improved Spot-Welding Control.** Harold J. Hague. *Welding Engineer,* v. 30, Feb. '45, p. 49.

The weld comparer makes use of the principle of the photoelectric cell to assure a continuous check of weld consistency. When this device is at work, welds of inferior quality can no longer sneak by unnoticed.

22-89. **Fabrication Cost vs. Width.** W. G. Theisinger. *Welding Engineer,* v. 30, Feb. '45, pp. 50-53.

To build the shell of a pressure vessel, which is more economical: a two-piece fabrication of wide plates or a three-piece or four-piece fabrication of narrower plates? Answer given here.

22-90. **Automatic Carbon-Arc Welding.** W. J. Conley. *Welding Engineer,* v. 30, Feb. '45, pp. 54, 56.

Aluminum is being successfully welded in production

set-ups by means of the automatic shielded carbon-arc process. Speed, quality and economy can be obtained.

22-91. **Producing Gas Welded Tubing From 2500 Pound Coils of Strip.** J. N. Bohannon and F. Judelsohn. *Steel,* v. 116, Feb. 26, '45, pp. 84-85, 102, 105.

Steel in transit from strip mill to tube plant is prevented from shifting by careful banding and packing. Compensation for variations in skelp thickness, analysis and condition is effected by changing speed of strip going through mill rather than altering pressure of oxygen and acetylene. Electronic control widely employed. Looping system provides for joining of coil ends without interrupting welding operation.

22-92. **Tin-Free and Low-Tin Solders.** C. A. Reichelderfer and B. W. Gonser. *Steel,* v. 116, Feb. 26, '45, pp. 86-88, 90, 92, 132, 134, 136.

Extensive use of solders for joining has necessitated the development of substitutes to meet the critical shortage of tin. Physical properties, limitations and modes of application of alternate types worked out for the War Metallurgy Committee presented. 9 ref.

22-93. **Special Setups Speed Automatic Welding of Masts and Kingposts.** G. Eldridge Stedman. *Steel,* v. 116, Feb. 26, '45, pp. 94, 96, 99, 128.

Operating details.

22-94. **Controlled Atmosphere Furnace Brazing.** A. K. Phillippi. *Industrial Heating,* v. 12, Feb. '45, pp. 222, 224, 226, 228, 230, 232.

Recommended practices, limiting factors, types of furnaces employed and their auxiliary equipment. Selection of heating equipment of the proper capacity. The advantages to be gained by the adoption of controlled atmosphere furnace brazing as a method of fabrication in those applications where it is feasible to do so, and where savings in cost may be expected.

22-95. **Diversity of Structures Produced with New Process of Automatic Welding.** *Steel Processing,* v. 31, Feb. '45, pp. 103-106.

One Ohio firm's utilization of single automatic welding unit for widely diversified types of assemblies which suggests the flexibility and all-around usefulness of this latest advancement in automatic welding equipment.

22-96. **Controlled Atmosphere Furnace Brazing.** A. K. Phillippi. *Steel Processing,* v. 31, Feb. '45, pp. 111-114.

If the parts are designed for furnace brazing, economies will be realized because expensive machining operations can be eliminated; the waste of metal in these machining operations can be saved; less material need be purchased; less chips and turnings will have to be handled by the salvage department; and in summing up the whole sequence of operations, it will be found that controlled atmosphere brazing operations result in a saving of both labor and material. Joining metals by atmosphere brazing is economical and basically sound.

22-97. **Design Considerations in Resistance Welding.** A. J. Hipperson. *Welding,* v. 13, Jan. '45, pp. 582-590.

Reviews the strength to be expected from different types of resistance welds, and the location of the welds with respect to the component parts. Also discusses the possibility of standardizing the use of symbols for resistance welds. 2 ref.

22-98. **Argon-Arc Welding.** *Welding,* v. 13, Jan. '45, pp. 591-594.

The development of a new process to avoid the difficulties which are present when using oxy-acetylene welding on magnesium alloys. It is stated that the new process offers a satisfactory means of obtaining sound, consistent welds in magnesium alloys from the consideration of both strength and metallurgical structure.

22-99. **Power Factor Correction of Resistance Welders.** W. B. Best. *Welding,* v. 13, Jan. '45, pp. 595-599.

Considers the large spot welder having a load factor of the order of 20%. If a condenser is permanently connected in parallel and if the capacity be calculated for the welding condition, practically the whole of the condenser capacity is superfluous as regards the welder for, say 80% of the connected time. This excess capacity may be so great as to cause over correction of other plant during periods when the welder is on open circuit.

22-100. **Electrode Coatings.** G. Haim. *Welding,* v. 13, Jan. '45, pp. 600-604.

Rapid determination of moisture content. 2 ref.

22-101. **Repair of Worn Rails.** *Welding,* v. 13, Jan. '45, pp. 605-606.

Introduction of non-ferrous running surfaces.

22-102. **Ice Damage Repairs to a Liberty Ship.** J. K. Johannesen. *Welding,* v. 13, Jan. '45, pp. 614-618.

Presents details of repairs which were carried out on a partially welded ship and outlines the difficulties encountered and how they were overcome. A prefabricated ship may be more costly to repair but the superior strength of the welded design should reduce the extent of the repairs necessary.

22-103. **Trends in the Use of Welded Machinery Parts.** Edward J. Charlton. *Welding Journal,* v. 24, Feb. '45, pp. 113-124.

Limited to components fabricated from low-carbon hot-rolled steel and its related alloys.

22-104. **Control of Welding Fumes — Why and How.** Morwick Ross. *Welding Journal,* v. 24, Feb. '45, pp. 124-126.

Brief review of the effects of exposures to welding fumes in shipyards today. It scarcely begins to tell the whole story, but it serves as one good reason why welding fumes must be controlled.

22-105. **Multiple and Stack Machine Cutting.** A. H. Yoch. *Welding Journal,* v. 24, Feb. '45, pp. 127-138.

The success of stack cutting is dependent first upon

thoroughness of advance preparations of the plates and, second, upon the proper technique of operation. The first prerequisite is composed of the three factors: (1) proper cleaning, (2) proper stacking, and (3) proper clamping.

22-106. **High Lights of Hard-Facing Procedure.** R. L. Lerch. *Welding Journal,* v. 24, Feb. '45, pp. 139-143.

Article written with special reference to the use of Haynes Stellite hard facing rod. Figures on savings and increased life are based on the use of this material.

22-107. **Safety Factors in Arc Welding.** R. F. Wyer. *Welding Journal,* v. 24, Feb. '45, pp. 146-150.

Safety factors in arc welding from the electrical point of view.

22-108. **Aluminum Spot Welding Tips.** Eugene J. Peltier. *Welding Journal,* v. 24, Feb. '45, pp. 151-153.

Outlines several points in aluminum spot welding which need special analysis.

22-109. **Welding versus Riveting on Hopper Dredge Construction.** S. E. Lawrence. *Welding Journal,* v. 24, Feb. '45, pp. 155-158.

Desirability of proper design for either welding or riveting in work of this type. Great field for savings to be effected in a plant in transition by following through from design to finished product, savings of weights of metals, economy of shapes, easier fabrication of sheets, simplification of fittings—dead weight saving of welding rods over rivets, etc. Savings of time were found harder to equate, due in part to the fact that facilities were not previously provided to expedite welding operations and due to lack of time to work out the simplest, most economical manner of welding a seam, i.e., whether overhead, down welding, side welding, etc. Units of price work costs were difficult to reduce to a common denominator for comparison.

22-110. **Welding of Dissimilar Metals.** W. Spraragen and D. Rosenthal. *Welding Journal,* v. 24, Feb. '45, pp. 65s-85s.

Properties of the joint are dependent primarily on the nature of the bond itself. The bond may be secured by the three following means: alloying, surface tension as in tinning, soldering or brazing (perhaps with some alloying) and intergranular penetration. Dissimilar ferrous metals; welding ferrous to non-ferrous metals; dissimilar non-ferrous metals. 130 ref.

22-111. **Lincolnweld Automatic Welder Shows Operating Economies.** C. M. Taylor. *Iron Age,* v. 155, March 1, '45, pp. 47-49.

In the fabrication of hatch covers for cargo ships, welding costs have been cut in half compared with manual methods. Details on the equipment are announced for the first time.

22-112. **Safety Factors in Arc Welding.** R. F. Wyer. *Railway Mechanical Engineer,* v. 119, March '45, pp. 128-131.

Hazards and required safety practices from the electrical point of view.

22-113. **The Flame Cutting of Steel.** Chas. A. E. Wilkins and Wm. J. Currie. *Metal Treatment,* v. 11, Winter '44-'45, pp. 259-265, 272.

Demonstrates how precision flame cutting has effected considerable saving in both time and production costs in the engineering industry. Stresses the importance of understanding the mechanics of the cutting process, and of appreciating the metallurgical reactions involved. Flame cutting has many advantages but one of its greatest is the way it eliminates superfluous machining operations.

22-114. **Welding Requirements for Various Stainless Steels.** W. J. Conley. *American Machinist,* v. 89, March 15, '45, pp. 112-115.

Choice of electrodes and other welding factors discussed.

22-115. **Destructive Effect of High Temperature Solders on Copper Wire.** R. H. Bailey. *Wire & Wire Products,* v. 20, March '45, pp. 197-199.

Life and diameter of any small to fine size copper wire in any solder is decreased with increasing molten solder temperatures. Higher the tin content of tin-lead solder, the shorter is the life of a given wire in that solder for any given solder temperature.

22-116. **The Welding of Non-Ferrous Metals.** E. G. West. *Sheet Metal Industries,* v. 21, Feb. '45, pp. 317-326, 327.

Weldability; differences between fusion and pressure processes; special technique necessary for non-ferrous metals; fusion processes; pressure processes; brazing; physical properties, effect of alloying additions on physical properties; mechanical properties; chemical and physico-chemical properties; gas solubility; metallurgy of non-ferrous welds; cast metal. 6 ref.

22-117. **Producing Gas Welded Tubing From 2500-Pound Coils of Strip.** J. N. Bohannon and F. Judelsohn. *Steel,* v. 116, March 5, '45, pp. 124-125, 140, 142.

Welding head with preheating, heating and welding section is built longer than average unit and thus provides for high speed production and uniform weld. Double row of orifices extend nearly to end of head. Tunnel in which tubing is given air quench is unique feature of new mill. Final cooling completed by simple water quench.

22-118. **Resistance Welding Machines.** H. O. Willrich. *Welding,* v. 13, Feb. '45, pp. 2-6.

Care and maintenance; electric system; the timing circuit; connection to the power main; air system; water cooling system; method of cleaning; electrode maintenance; seam welding wheels.

22-119. **Carbon Arc Welding.** P. L. Pocock. *Welding,* v. 13, Feb. '45, pp. 7-12.

Survey of the process.

22-120. **Arc Welding Armour Plate.** W. M. Blagden. *Welding,* v. 13, Feb. '45, pp. 13-19.

Design of British fighting vehicles.

22-121. **Welding Metallurgy of Non-Ferrous Metals.** E. A. G. Liddiard. *Welding,* v. 13, Feb. '45, pp. 20-24.

Magnesium base alloys; effect of flux; argon arc welding; welding of copper; prospect of future developments; recrystallization welding.

22-122. **Welded I-Sections.** H. Gottfeldt. *Welding,* v. 13, Feb. '45, pp. 29-34.

Graphical solutions to design problems.

22-123. **What's New in Welding.** *Fortune,* v. 31, March '45, pp. 151-154, 182, 184, 186, 189-190.

New processes, new machines, a million men and women who can handle the "stinger." The prospect: Cheaper and faster metal fabrication in peacetime.

22-124. **Some Effects of Surface Decarburization on Flame-Cutting Characteristics of High Carbon Bar Stock.** *Canadian Metals & Metallurgical Industries,* v. 8, Feb. '45, pp. 26-28.

Presented with the view that it will have further practical applications, particularly so considering the current trend towards the use of flame-cutting processes as initial machining operations with consequent savings realized through the reduction in the amount of waste material to be removed by rough machining.

22-125. **The Copper-Brazing of Steel Assemblies.** J. D. Jevons. *Overseas Engineer,* v. 18, Nov. '44, pp. 28-31, 50. Iron and Steel Institute *Bulletin,* no. 109, Jan. '45, p. 80-A.

A description is given of the copper-brazing process. Under industrial conditions it consists of assembling steel components with definite clearances and in such a manner that they remain in the desired position until the joint is made; pure copper in the form of wire, foil or powder (made up as a paste) is placed in a position from which, when molten, it will flow readily into the spaces to be filled; the assembly is heated and held for 5 to 10 min. at about 1120° C. in a reducing atmosphere and then cooled, usually in the same atmosphere, by passing through a tunnel furnace with a cooling zone.

22-126. **The Study of Electrode Tip Wear in the Spot Welding of Mild Steel Sheet.** W. S. Simmie. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 135-140.

Amount of tip wear obtained depends upon the shape of the electrode tip. It can be reduced by using chromium-copper. Increase in tip area is not related to the increase in actual contact area.

22-127. **Oxy-Acetylene Welding; a Survey of Problems Associated With Design and Technique.** F. Clark. *Sheet Metal Industries,* v. 21, Jan. '45, pp. 141-145, 150.

Satisfactory welding depends upon team work from the time welding is considered by the designer and the engineer, until it is completed by the welder. Care of

preparation of welding edges, the spacing of the joints and alignment are as important for welding as the setting out and drilling of rivet holes are for riveting. Variation of angle of bevel will upset initial calculations for time and cost and add unnecessarily to the welders' difficulties. The wider the vee the more weld metal will be required, the slower will be the welding speed and the greater the gas consumption. Careful clamping or use of property designed jigs is frequently warranted.

22-128. **Fusion Welding Copper, Brass and Bronze.** H. R. Morrison. *Welding Journal,* v. 24, March '45, pp. 225-230.

Weldable alloys of copper fall into four general groups: Copper and those other materials that contain a small enough percentage of alloying elements or impurities to be considered in the same class with copper; copper-zinc alloys, or brasses; copper-tin alloys, or bronzes; copper-silicon alloys, including Everdur metal. Each group consists of alloys of copper that have welding techniques, properties and characteristics that are alike or very similar.

22-129. **Electric Arc Welding Helps Make Mass Production of Penicillin Possible.** G. G. Landis. *Welding Journal,* v. 24, March '45, pp. 232-234.

Officials of the 19 principal plants in the United States, which are said to produce about 95% of the world's supply of penicillin, agree that without the benefits of modern welding techniques, it would not have been possible to reach today's peak of penicillin production which is expected to soon exceed a volume sufficient to treat 250,000 serious infections per day.

22-130. **Failure of Spherical Hydrogen Storage Tank.** A. L. Brown and J. B. Smith. *Welding Journal,* v. 24, March '45, pp. 235-240.

A spherical hydrogen storage tank failed structurally with explosive violence. It was made of welded steel plate, and materials, design and erection were in accordance with the American Society of Mechanical Engineers' Code. Occurrence of fractures; the cause; description of sphere; improbability of internal explosion; the manhole; description of manhole; residual shrinkage stresses from welding; sheared edge of manhole neck; stresses from internal gas pressure; cumulative effect of stresses and sheared edge.

22-131. **Production Problems and Production Control.** E. C. Brekelbaum. *Welding Journal,* v. 24, March '45, pp. 241-246.

New production welding system (based on the base-rate-plus-premium method of compensation) which does precisely what its name implies—it provides a complete control of all phases of welded fabrication. It employs the use of arc timers and recorders which will be explained.

22-132. **Technical Control of Welding in Ship Construction.** M. H. MacKusick. *Welding Journal,* v. 24, March '45, pp. 247-253.

Incentive systems of pay; qualifications of welding operators; organization for shipyard welding production; automatic welding; planning for subassembly; thermit welding.

22-133. **Controls Required for Safe and Economical Construction of Welded Ships.** Donald G. Maxson. *Welding Journal,* v. 24, March '45, pp. 255-264.

To sum up a few of the most pertinent premises necessary to the construction of safe and economical all-welded ships; it appears very evident that the following must be observed: (a) A basic policy; (b) control of residual stresses; (c) inspection.

22-134. **Some Applications of Welded Aircraft Tubing.** J. S. Adelson and Park Hill. *Welding Journal,* v. 24, March '45, pp. 267-269.

Engine mounts; aircraft intake tubes; aircraft exhaust header.

22-135. **Weldability; Hot-Rolled Versus Quenched and Tempered Constructional Steels.** S. A. Herres. *Welding Journal,* v. 24, March '45, pp. 129s-152s.

Develops a comparison between the weldability of several steels in various heat treat conditions; considers what weldability means and how it can be evaluated and specified. 23 ref.

22-136. **Spot Weld Characteristics of Heavy Gages of 24S-T Alclad Aluminum Alloy.** M. L. Ochieano. *Welding Journal,* v. 24, March '45, pp. 157s-166s.

Characteristics of spot welds made on a double-impulse d.c. welder. Tests were conducted to determine shear and tension strengths and consistency on 0.091, 0.102 and 0.125 24S-T Alclad. Program expanded to include 0.156 24S-T Alclad. Tests were conducted on shear strength specimens only.

22-137. **Spot Welding High-Tensile Steels with Automatic Post-Heat Treatment.** W. S. Simmie and A. J. Hipperson. *Welding Journal,* v. 24, March '45, pp. 174s-182s.

Determines the extent to which spot welds in certain high tensile steels can be made sufficiently free from brittleness for structural purposes by means of the passage of a post-heat treatment current of short duration in the spot-welding machine, following the actual welding cycle. 4 ref.

22-138. **Summary of Observations of Cracking in Spot Welds in Alclad 24S-T.** Robert A. Wyant. *Welding Journal,* v. 24, March '45, pp. 183s-185s.

Summarizes the information on cracking that has been more fully discussed in the progress reports from Welding Laboratory, Rensselaer Polytechnic Institute.

22-139. **Investigations Into Manual High-Speed Arc Welding.** E. S. Waddington. *Sheet Metal Industries,* v. 21, March '45, pp. 501-508.

Discusses the main factors in welding costs: Cost of preparation; the welder's time; the cost of the electrode; the cost of current.

22-140. **The Welding of Non-Ferrous Metals.** E. G. West. *Sheet Metal Industries,* v. 21, March '45, pp. 509-513.

Metallurgy of non-ferrous welds. 4 ref.

22-141. **The Welding of Process Piping.** Arthur N. Kugler. *Heating and Ventilating,* v. 42, March '45, pp. 65-68.

How to join one metal with another. Influence of lead on welding; welding copper to copper; electrolytic copper.

22-142. **Tank Fabrication Costs Reduced by Automatic Arc-Welding Method.** C. M. Taylor. *Machinery,* v. 51, March '45, pp. 172-173.

Cost reduction of more than 40% over manual welding has been achieved in storage-tank fabrication by the automatic "Lincolnweld" method.

22-143. **Welded Construction of Blast Furnaces.** Bruce E. Tau. *Blast Furnace and Steel Plant,* v. 33, March '45, pp. 343-369-370.

Preparation of material for welding; erection and assembly; positioning, securing, and aligning plates; technique of welding; control of welding quality.

22-144. **Brazing Speeds Aircraft Construction.** *Iron Age,* v. 155, March 15, '45, pp. 66-68.

Part or application; metals joined; type of joint; alloy used.

22-145. **Supervisory Hints for Increased Production.** R. Kraus. *Industry & Welding,* v. 18, March '45, pp. 35-37.

Observations confined to general principles involving welded fabrication and operations connected with it.

22-146. **Flame Cutting—Metal Spraying.** William J. Murray. *Industry & Welding,* v. 18, March '45, pp. 38-39, 42.

New manufacturing methods and procedures result in great improvement.

22-147. **Design of Welded Machinery.** John Mikulak. *Industry & Welding,* v. 18, March '45, pp. 43-44, 46, 91-96.

Selection of materials; joint design; procedure for welding; design trends.

22-148. **War Welding Developments for Peacetime Products.** J. M. Diebold. *Industry & Welding,* v. 18, March '45, pp. 48-50, 52, 54, 76-81.

New production techniques succeeded in applications hitherto considered impractical, and now forecast tremendous improvements in the peacetime products to come.

22-149. **New Variation in Tool Joint Hard Facing Technique.** *Industry & Welding,* v. 18, March '45, pp. 56-58.

Covers approximately the same surface but the method of applying the hard metal is novel. A handwheel or chain wrench is used to rotate the pipe upon which a circumferential bead of high carbon is applied

in a continuous spiral around the joint. Beads are spaced about ¼ in.

22-150. **Interval Timer, A-C Arc Welder Power Supply Among Subjects Discussed at A.I.E.E. Winter Technical Meeting.** *Industry & Welding,* v. 18, March '45, pp. 66, 68-69.

Interval timer for arc duration; power supply for a.c. arc welding; analysis of arc welding reactors.

22-151. **Properties of Stainless Steels Affect Welding Methods.** W. J. Conley. *American Machinist,* v. 89, March 1, '45, pp. 91-94.

One type of stainless steel is soft after welding; another is relatively brittle. These and other facts about the material discussed. Some of the new applications developed during the wartime emergency are also reviewed.

22-152. **Welding Light-Gage Steel.** R. V. Anderson. *Steel,* v. 116, March 12, '45, pp. 104-105, 150.

At high speed by submerged arc process facilitated by new developments in fixtures.

22-153. **New Silver Soldering Technique.** *Sheet Metal Worker,* v. 36, Feb. '45, pp. 35-36.

New technique for the use of silver solder and other low melting point alloys has practically eliminated the principal non-productive finishing operations. Essence of the improvement is the automatic supply of the flux to the joint in the correct amount and at a uniform rate.

22-154. **Skip Welding Prevents Distortion.** E. J. Henderson. *Iron Age,* v. 155, March 15, '45, pp. 63-65.

Unusual procedures worked out in the fabrication of naval cartridge case chutes from high tensile formed steel plate and stainless steel bars.

22-155. **Hazards in Arc Welding.** R. F. Wyer. *General Electric Review,* v. 48, March '45, pp. 20-25.

Facts replace rumors. Real dangers analyzed. Safety education and proper maintenance remove most hazards.

22-156. **Automatic Arc Welding of Aluminum Structures.** W. J. Conley. *Iron Age,* v. 155, March 22, '45, pp. 54-55.

Smooth welds can be obtained in ¼-in. aluminum carbon sheets at speeds up to 16½ in. per min. with automatic arc welding equipment, without the necessity of beveling the edges of butt welds. The automatic carbon arc process for welding aluminum described is now being used on a vast scale to fabricate special military bridge structures.

22-157. **Metal Cleaning Before Silver Brazing.** Jean Gauthier. *Iron Age,* v. 155, March 22, '45, pp. 56-58.

Common cause of trouble in silver brazing operations is poorly cleaned surfaces. Alkaline and acid cleaning solutions used with proper pH control can consistently provide chemically clean surfaces necessary for joining any metal surfaces.

22-158. **Developments in Arc Welding.** *Sheet Metal Worker,* v. 36, March '45, pp. 47-48.

Improvement in electrodes—increase in speed using less deposited metal, reducing man hours and cost.

22-159. **Low Temperature Welding in Steel Plant Maintenance.** R. D. Wasserman. *Iron and Steel Engineer,* v. 22, March '45, pp. 70-74, 84.

By proper choice of welding alloys for the material to be joined, welds can be made at temperatures materially lower than normal. The characteristics of these low temperature welds and the ease of their application open a wide field of use in plant maintenance.

22-160. **Welding in Steel Construction Work.** L. E. Browne. *Steel,* v. 116, March 26, '45, pp. 115, 146, 148.

Presents opinions from a cross-section of leading structural shop engineers and designers; some connected with large-tonnage shops and others with smaller companies in all sections of the country.

22-161. **Welding in the Railroad Shop.** Arthur Havens. *Welding Engineer,* v. 30, March '45, pp. 35-37.

Arc and oxy-acetylene welding don't compete in railroad maintenance. Each has its own particular set of maintenance jobs.

22-162. **Welded Gas Generators.** T. B. Jefferson. *Welding Engineer,* v. 30, March '45, p. 38.

Hydrogen to inflate barrage balloons, carbon dioxide to fight fires—both of these gases are being manufactured on the battle front in portable, all-welded generators.

22-163. **Self-Descaling Evaporator Tubes.** Clyde B. Clason. *Welding Engineer,* v. 30, March '45, p. 47.

Fresh water from the sea is now a working proposition for merchant ships. Up to 50 tons daily can be produced in a new sea-water still that uses heat-exchanger tubes made by silver brazing strips of Monel to brass tubing.

22-164. **Welded Aircraft Tubing.** J. S. Adelson and Park Hill. *Welding Engineer,* v. 30, March '45, pp. 48-50.

Tubing is one of the major steel products employed for aircraft construction. The authors of this article tell how it must be fabricated to serve in motor-mount rings, engine intake tubes and stainless steel exhaust headers.

22-165. **The Repair and Salvage of Aluminum Castings by Arc Welding.** C. R. Thatcher. *Aluminum and the Non-Ferrous Review,* v. 9, July-Sept. '44, pp. 35-36, 38.

Electric arc welding used on aluminum castings as formerly used in repairing cast steel and phosphor-bronze castings. Eliminates blowholes which have appeared in the casting, either before or after machining. Corrects machining errors wherever distortion does not present too difficult a problem.

22-166. **Brazing.** *Automobile Engineer,* v. 35, Feb. '45, pp. 69-70.

Current practice in the U.S.A.

22-167. **Electronic Controls for Resistance Welding.** H. L. H. *Machinery* (London), v. 66, Feb. 8, '45, pp. 143-148.

Controlling the heat generated at the weld; non-synchronous and synchronous timing control; elements of the spot-weld cycle; classification of timers; control of voltage variation; electronic control for the storage-type of welder; resistance welding before the war; electronic controls with special functions.

22-168. **Welding of Aluminum and Its Alloys.** J. R. Morrill. *Western Metals,* v. 3, March '45, pp. 9-11.

Discusses some of the principal factors relating to the use of this modern process as it is now being successfully practiced.

22-169. **Nation's Welded Pipe Line Construction During War Years Totals Over 18,000 Miles.** C. M. Taylor. *Petroleum Engineer,* v. 16, March '45, pp. 143, 146, 148, 150.

Stove-pipe method of welding continues as trend in construction of pipe lines; widely used on large sizes.

22-170. **Pressure Welding Overland Pipe Lines.** E. P. Jones. *Petroleum Engineer,* v. 16, March '45, pp. 214, 216, 218, 220.

Major features of the pressure welding process and outlines some of the recent developments in process and equipment.

22-171. **Spot Welding of Magnesium Alloys.** Kenneth E. Dorcas and N. H. Simpson. *Iron Age,* v. 155, April 5, '45, pp. 50-53.

Optimum machine settings on two types of stored energy welders have been worked out experimentally for various gages of magnesium alloys. In an attempt to improve shear strength values and their consistency a chemical precleaning technique has been developed that is superior to wire brushing in many respects. The relative effectiveness of chemical protective finishes applied after spot welding has also been studied.

22-172. **Cost of Welded Structures Compared With Iron Castings.** W. J. Conley. *Iron Age,* v. 155, April 5, '45, pp. 58-61.

To disprove the statement that certain finish machined weldments cost twice as much as finished castings, the results of an informal survey of welding fabricators made by his company both here and abroad are summarized.

22-173. **Sequence Control for Automatic Riveting.** Walter Mandel. *Iron Age,* v. 155, April 5, '45, pp. 62-64.

Electronic sequence control for increasing the efficiency of Model 2002 Erco riveters.

22-174. **Modern Applications of Arc Welding.** W. J. Conley. *Steel Processing,* v. 31, March '45, pp. 176-177, 183-185.

Its many advantages for increased production.

22-175. **Resistance Welding.** *Railway Mechanical Engineer,* v. 119, April '45, pp. 166-168.

Distinctions between various applications of the process.

22-176. **Flash Welding SAE 4130 Steel.** W. W. Ackerman and Walter Pestrak. *Steel,* v. 116, April 9, '45, pp. 104-105, 140, 142, 144, 146.

Advantages of the flash welded joint over the fusion welded joint are: Better physical characteristics (100% joint strength); lower weights; cheaper and faster production with less operator skill; no warping as a result of welding; less brittleness at low temperatures such as are encountered at high altitudes; higher fatigue strength.

22-177. **Influence of Inclination of Welds to Direction of Stress.** *Combustion,* v. 16, March '45, pp. 45-47.

When computing welds it is common practice to assume a higher joint efficiency along the weld than perpendicular to it. Consequently, inclination of the weld in the direction of stress should bring about an increase in load, and this assumption has led to some firms adopting spiral welds in pipe lines and drum construction. Tests on tensile bars and model drums, however, have now shown that it is only with relatively low joint efficiencies and very small angles between the axis of the weld and the principal direction of stress that any real increase in load can be achieved.

22-178. **Silver Alloy Brazing.** A. M. Setapen. *Metal Industry,* v. 66, March 23, '45, pp. 180-183.

Use of silver brazing alloys has increased many fold, and concurrently there has been a decided trend towards high speed production methods of heating. Prominent among these is the use of electric induction. (Presented to the Electrochemical Society.)

22-179. **Atomic Hydrogen Welding of Cutting Tools.** Eric N. Simons. *Industry and Welding,* v. 18, April '45, pp. 30-31, 94-96.

New British process solves problem of lost carbon and hardness, and results indicate test tools can be used on materials of all types, ranging from low carbon steel to hard and tough alloy steels having a tensile strength of 100 tons per sq. in.

22-180. **Building and Welding Braces in Heavy Industry.** E. E. Gentry. *Industry and Welding,* v. 18, April '45, pp. 32-33.

Method saves time, work and material and speeds up production and is safer.

22-181. **The Welding Processes at Boeing.** Charles Thompson. *Industry and Welding,* v. 18, April '45, pp. 34-37, 92-93.

Five forms of welding utilized at Boeing, namely, oxy-acetylene, oxygen-hydrogen, electric arc, flash and spot welding. Tells how each is applied.

22-182. **Arc Welding Propeller Shaft and Collar.** Herb Hose. *Industry and Welding,* v. 18, April '45, pp. 44, 46.

Shaft and collar welded with coated aluminum

bronze electrodes received no preparation of any kind except preheating to approximately 400° F. Only two passes were required to deposit a ⅝-in. fillet.

22-183. **Bending and Straightening With the Torch.** *Industry and Welding,* v. 18, April '45, pp. 48-49, 53, 55, 82-83.

Application of heat to a localized area of metal in such a way that the resulting expansion is hindered by surrounding rigid cold metal, causing the hot metal to upset. Upon cooling, the steel contracts in at least one direction, to a length less than its original length. Material prepared by La Motte Grover and Forest Walds of Air Reduction Sales Co., presentation of the Canadian Welding Review. Recapitulates much of the material originally given on the subject in *Industry and Welding* during 1941-42.

22-184. **Basic Joint Design for Welding Process.** C. H. Jennings. *Industry and Welding,* v. 18, April '45, pp. 56-58, 60, 62.

Forge, acetylene and thermit described. Welding is accomplished in five principal ways: (1) Forge welding, (2) gas welding, (3) thermit welding, (4) electric arc welding and (5) resistance welding.

22-185. **Submerged Arc Welding Steps Up Production of Invasion Boat Assemblies.** *Industry and Welding,* v. 18, April '45, pp. 78-80.

Welding of large, flat plate sections has been found ideally suited to the submerged arc type of automatic welding, due to high welding speed with a minimum of distortion, and exceptionally fine quality of work.

22-186. **Rod Processing Plant.** *Industry and Welding,* v. 18, April '45, pp. 86-87.

New principle of extruded flux application. Centralized control panel by which one man can start and stop every unit in the plant, compact seven-pass oven saving 40% on floor space. Improved mechanism which transfers the electrodes from one pass within the oven to the next in accurate alignment without dropping or rolling. A new type of slug press.

22-187. **The Welding of Process Piping.** Arthur N. Kugler. *Heating and Ventilating,* v. 42, April '45, pp. 71-74.

Metal arc welding process is the method preferred for welding straight chromium irons and steels and the austenitic chromium-nickel steels, since shielded arc electrodes are available for use with virtually every analysis of base metal. Brazing with the silver-cadmium-copper-zinc alloy offers possibilities where the heat of welding might cause difficulties with these critical alloys. Application of the gas shielded arc welding process is so new that complete data are not available. Braze welding is included as a possible process but its use should be restricted to emergency repairs or those situations where the copper-base alloy filler metal will not cause trouble.

22-188. **A Quantitative Study of Soft Soldering by Means of the Kollagraph.** L. G. Earle. Institute of Metals *Journal,* v. 71, Feb. '45, pp. 45-72.

"Jointing capacity" may be analyzed into two independent characteristics of the soldering system: Its time-temperature-wetting characteristic and its interfacial-tension characteristic. An apparatus, called the Kollagraph, for measuring these two independent characteristics, described. Effect of the tin content of the solder, the alloy additions to the solder, the basic stock, the thickness of the stock, the type of flux, and preheating are discussed; the general conclusion is reached that most types of solder are selective in their reaction to different basis stocks and fluxes. 8 ref.

22-189. **Spot Welding of Magnesium Alloys.** Kenneth E. Dorcas and N. H. Simpson. *Iron Age,* v. 155, April 12, '45, pp. 68-73.

Results of tests of many cleaning agents before a chemical cleaner was developed that is comparable in its effect to wire brushing, according to readings on a surface resistance meter devised at Fort Worth. Relative effectiveness of chemical protective finishes applied after spot welding is also revealed.

22-190. **Brazing Small Assemblies—a Cost and Quality Comparison.** O. A. Kehle. *Product Engineering,* v. 16, April '45, pp. 274-276.

Small, complicated parts analyzed for possible production as furnace-brazed sub-assemblies. Cost comparisons between brazed assemblies and machined parts or forged and machined parts included.

22-191. **Oxy-Acetylene Pressure Welding Has Wide Production Possibilities.** *Machinery,* v. 51, April '45, pp. 180-187.

Originally applied to operations in the railway and oil fields, it is being increasingly employed in factory production. Oxy-acetylene pressure welding is an automatic process in which the work-pieces are joined while in the solid state without the addition of any melted metal. Process is especially adaptable to the welding of high carbon and alloy steels, which are welded with difficulty by fusion methods.

22-192. **The Aim of Welding — One Quality — the Best.** E. Fuchs. Institute of Welding *Transactions,* v. 7, Nov. '44, pp. 104-115.

Shows from specific cases that any but the best welding does, in fact, lead to failures, and indicates how certain well-defined faults can largely be avoided. 1 ref.

22-193. **Propeller Shaft Struts.** *Steel,* v. 116, April 16, '45, pp. 110-111.

Fabricated by Thermit welding.

22-194. **Sequence of Operations in Ship Welding.** Jack D. Wadling. Institute of Welding *Transactions,* v. 7, Nov. '44, pp. 116-122.

Diverse nature of problems which confront the designers and builders of welded ships and the almost insuperable difficulties of laying down hard and fast rules covering such items as sequence of welding.

22-195. **Arc Welding Procedure With Special Reference to Shipbuilding.** W. G. John. Institute of Welding *Transactions,* v. 7, Nov. '44, pp. 123-128.

Welding techniques are still in the development stages, but general guidance can be given, and investigations are proceeding. Consideration is given to the importance of welding procedures as affecting structural efficiency and economy of production; design of butt joints; use of fillet welds; positioning of the work; large gage electrodes and deep penetration welding; peening; automatic welding; welding on structural forgings and castings and heavy material. Attention is drawn to the need for planning the work, training the welder and providing effective supervision.

22-196. **The Pickling of Alclad D.T.D. 390 and Duralumin B.S.S. 5L3 Prior to Spot Welding.** R. F. Tylecote and R. W. Pittaway. Institute of Welding *Transactions,* v. 7, Nov. '44, pp. 129-136.

Pickling of light alloys prior to spot welding must be regarded from two points of view: (1) That of reducing the resistance due to the oxide film present on the surface of the sheets in contact with the electrodes, i.e. the electrode-sheet contact resistance; and (2) reducing the contact resistance between the sheets, i.e. sheet-to-sheet resistance. Shows the advantages to be gained by reducing the sheet-to-sheet resistance. 1 ref.

22-197. **Use of High Frequency Ionizing Devices for Arc Welding.** H. P. Zade. *Welding,* v. 13, March '45, pp. 50-53.

Physical phenomena relating to the welding arc discussed in brief. Advantages of an additional ionization of the arc stream. Method of providing ionization by means of superimposed high frequency current, and the application to arc welding problems.

22-198. **Manual Carbon Arc Welding.** P. L. Pocock. *Welding,* v. 13, March '45, pp. 54-60.

Investigations carried out on different materials and with different joints. Results tabulated.

22-199. **Design of Welded Structures. Part II.** J. Corston MacKain. *Welding,* v. 13, March '45, pp. 61-67.

Water storage tanks.

22-200. **Zinc Base Die Castings.** E. Christie. *Welding,* v. 13, March '45, pp. 68-70.

Explains the problem of welding this type of die casting and describes the best procedure for repair work; emphasizes that this class of repair calls for considerable skill and experience.

22-201. **Arc Welded Engine Mountings.** *Welding,* v. 13, March '45, pp. 73-80.

Production of Avro-Lancaster sub-frames; crack detection; drilling operations.

22-202. **Treadle-Operated Spot Welders.** E. Leede. *Welding,* v. 13, March '45, pp. 81-82.

Interlocking device designed to correct the bad habit of not pressing the treadles of non-automatic spot welders down to the full extent.

22-203. **Oxy-Acetylene Welding of Copper.** *Aluminum and the Non-Ferrous Review,* v. 9, Oct.-Dec. '44, pp. 56, 58-59.

It has been found that the successful welding of copper depends upon base material and alloy filler rod of suitable composition, a suitable flux conveniently applied, correct welding technique and experience.

22-204. **Heliarc Welding of Aluminum.** *Welding Engineer,* v. 30, April '45, pp. 34-37.

Heliarc welding process was originated for the arc welding of magnesium, but it can be successfully used for aluminum. Curtiss-Wright technicians found Heliarc welding satisfactory for the fabrication of big airplane wing tanks.

22-205. **Sequence for Shipbuilding.** Milton Forman. *Welding Engineer,* v. 30, April '45, pp. 42-43.

Organized fitting and welding is the cornerstone for shipbuilding practices at Ingalls yard. A successful welding sequence must be an integral part of the planning and the construction of every vessel.

22-206. **Flame-Cut Expansion Joints.** R. M. Dennis. *Welding Engineer,* v. 30, April '45, pp. 44-45.

Silent, joltless, and trouble-free expansion joints for highway bridges are being produced by flame-cutting a series of interlocking "fingers" in thick steel plate.

22-207. **Flash Welding 4130 Steel.** W. W. Ackerman and Walter Pestrak. *Welding Engineer,* v. 30, April '45, pp. 46-49.

While SAE 4130 steel is of outstanding weldability, it presents some problems in flash welding. Parts must be properly designed for this application, and flashing and upset times as well as upset pressures are critical.

22-208. **Welding in the Railroad Shop.** Arthur Havens. *Welding Engineer,* v. 30, April '45, pp. 38-40.

Railroad welding jobs fall naturally into those that are done by oxy-acetylene welding, and those done by arc welding. Cites a number of examples of each.

22-209. **Elements of Tool-Steel Welding.** Arthur R. Butler. *Welding Engineer,* v. 30, April '45, pp. 50-52.

Reconversion will mean that new tools and dies will be needed in a hurry. Summarizes the fundamental principles of this specialized welding phase.

22-210. **Automatic Welding Booms.** *Welding Engineer,* v. 30, April '45, p. 56.

Ship booms—tapered, tubular structures formed of 1010 steel. Large numbers are needed, but volume production could not be achieved until automatic welding was applied to the longitudinal seams.

22-211. **Templet Tips.** *Oxy-Acetylene Tips,* v. 24, April '45, pp. 46-48.

Practical suggestions on making strip templets for cutting difficult shapes.

22-212. **Do You Follow Good Practices in Operating Your Acetylene Generators.** *Oxy-Acetylene Tips,* v. 24, April '45, pp. 49-51.

Good practices; cautions; changing shifts; freezing.

22-213. **A Carrying Case for Welding and Cutting Apparatus.** *Oxy-Acetylene Tips,* v. 24, April '45, pp. 57-58.

Protect valuable equipment and save time with a homemade sheet metal box.

22-214. **How to Recondition Cutting Nozzles and Welding Heads.** *Oxy-Acetylene Tips,* v. 24, April '45, pp. 58-64.

Step-by-step instructions for restoring damaged tips to serviceable condition.

22-215. **Silver Alloy Brazing.** A. M. Setapen. *Metal Industry,* v. 66, March 30, '45, pp. 198-200.

Design of single and multi-turn induction coils for specific purposes. Simplicity of operation, low cost, high speed and control of heat are the advantages claimed for this method of silver alloy brazing. (Electrochemical Society.)

22-216. **Automatic Arc Welding.** R. F. W. *Machinery* (London), v. 66, April 5, '45, pp. 361-366.

Improved automatic arc-welding machines and equipment are capable of reducing costs, increasing production, and improving quality.

22-217. **Dissimilar Metals.** *Iron & Steel,* v. 18, April '45, p. 123.

Joining by electric arc welding.

22-218. **The Strength of Riveted Joints.** I. G. Bowen. *Aircraft Engineering,* v. 17, March '45, pp. 83-87.

Results of a statistical analysis of test data.

22-219. **Identifying the Constituents of Welding Electrode Coatings.** R. C. Vickery. *Iron Age,* v. 155, April 19, '45, pp. 62-66.

Scheme involving magnetic and gravitational separation that gives surprisingly accurate results. (From *Metallurgia.*)

22-220. **Automatic Carbon Arc Welding Found Advantageous for Aluminum.** W. J. Conley. *American Machinist,* v. 89, April 26, '45, pp. 118-120.

Fabrication by the carbon arc method promises to widen the field of use of aluminum and its alloys. Method permits faster and more uniform welds.

22-221. **Fabrication Cost of Boilers, Tanks and Pressure Vessels as Affected by Plate Widths.** W. G. Theisinger. *Welding Journal,* v. 24, April '45, pp. 327-337.

Costs of unnecessary fabricating operations; fabricating costs and width extras; multiple-course construction; saving man-hours in fabrication; field inspection of joints; allowable overweight of plates; width extras and low alloy steels; one-piece crown and side construction in locomotive fireboxes; plate widths in clad steels; solid stainless and non-ferrous metals.

22-222. **Procedure Control of Automatic Welding Processes.** A. E. Bedell and J. B. Quigley. *Welding Journal,* v. 24, April '45, pp. 339-345.

Discussion confined to such automatic machine welding processes as are suitable for heavy plate fabrication of mild and certain alloy steels. Processes may be divided into three general types: Shielded metallic arc, completely shielded submerged arc and carbon arc-shielded. Discusses briefly the outstanding advantages and disadvantages of each of these general types on various classes of work.

22-223. **Production Planning for Welded Ship Construction with Paper and Plastic.** *Welding Journal,* v. 24, April '45, pp. 347-350.

With the aid of a scale plastic model which has been lofted to exact measurements, all parts of ship have been carefully planned and an erection program outlined.

22-224. **Organized Fitting and Welding in Shipbuilding.** Milton Forman. *Welding Journal,* v. 24, April '45, pp. 351-357.

Planning vs. work; sequence.

22-225. **Chemical and Metallurgical Control in Welding.** E. C. White. *Welding Journal,* v. 24, April '45, pp. 361-363.

Chemical and metallurgical division in a welding department should be staffed with personnel of broad experience and sound technical background in chemistry and metallurgy. Speedy metallurgical preparation of test information is absolutely necessary. All supervisors must arrive at a sound appraisal of the relative importance of macro sections, tensile tests, visual inspection of welds, etc.

22-226. **Unusual Applications of Gas Cutting to Ordnance Fabrication.** C. M. Underwood. *Welding Journal,* v. 24, April '45, pp. 365-377.

Designing for welding; multiplane cutting; cutting on base ring structurals; travograph set-up on base ring; vertical cutting; smaller cutting operations; tube cutting machine; special pantograph; contour beveling attachment; finishing cuts on weldments.

22-227. **Helium-Shielded Arc Welding.** L. V. Barber and H. S. Kennedy. *Welding Journal,* v. 24, April '45, pp. 378-380.

Helium-shielded arc welding contributed to the greatly expanded use of magnesium and its alloys in industry because of the affinity of magnesium for oxygen and nitrogen, especially at high temperatures. Welding of magnesium and its alloys was impossible before the process of welding in an inert-gas atmosphere was introduced. Details of process given. Application to stainless steel.

22-228. **Gas Evolution in Arc Welding Steels and Its Effects Upon the Welding Process.** Morton C. Smith. *Welding Journal,* v. 24, April '45, pp. 226s-229s.

Gas evolution during the arc welding of steels discussed on the basis of the type and quantity of gas

liberated; it is demonstrated that a large volume of carbon monoxide must normally be evolved from molten filler and weld metal during the welding process in air. Evolution of carbon monoxide from the metal is suggested as the primary cause of metal transfer across the arc in vertical and overhead welding, of spatter loss of weld metal, of the formation of the welding crater, and of porosity in the completed weld. 6 ref.

22-229. **Weldability of Manganese-Silicon High Tensile Steels.** George G. Luther, Francis H. Laxar and Clarence E. Jackson. *Welding Journal,* v. 24, April '45, pp. 245s-254s.

Weldability of the experimental manganese-silicon steels without titanium or vanadium is superior to that of commercial carbon-manganese steels and compares favorably with that of commercial carbon-manganese steels with additions of vanadium and titanium. Manganese-silicon steels have less tendency for underbead cracking. No cracking tendency was evident for experimental manganese-silicon steels. 4 ref.

22-230. **Welded Locomotive Boiler Construction.** James Partington. *Railway Age,* v. 118, April 28, '45, pp. 752-753.

Railroads must be proponents of all-welded boilers before this type of construction is widely used. Welding code adopted; steps to good welding; advantages of welded boilers; material.

22-231. **An Engineering Approach to Soldering with Tin-Lead Alloys, II.** A. Z. Mample. *Metals & Alloys,* v. 21, April '45, pp. 1000-1006.

Discusses fluxes, soldering devices and the mechanical quality of soldered joints, and presents a useful summary of the whole problem and practice for design, materials and process engineers.

22-232. **Which Carbon Steel for Arc Welding?** W. J. Conley. *Metals & Alloys,* v. 21, April '45, pp. 1006-1008.

Discussion of the composition grades of low-carbon steel that are best suited for high-speed manual arc welding. 4 ref.

22-233. **Welding Symbols.** *Metals & Alloys,* v. 21, April '45, pp. 1037-1039.

Diagram.

22-234. **Aircraft Welding.** H. O. Klinke. *Canadian Metals & Metallurgical Industries,* v. 8, April '45, p. 41.

Resistance welding; fusion welding; quality.

22-235. **Magnesium Alloy Fabrication.** J. V. Winkler. *Metal Industry,* v. 66, April 20, '45, pp. 248-250.

Reviews the various methods used to join magnesium alloy parts and discusses the processing involved in fabricating structures by these methods. (From American Society for Metals.)

22-236. **Some Safety Factors in Arc Welding.** R. F. Wyer. *Railway Signaling,* v. 38, May '45, pp. 316-318.

Hazards involved and the safety practices that should be observed in arc welding. Contrary to popular be-

lief, arc welding is not a hazardous occupation, if the work is done in accordance with recommended safety rules.

22-237. **Spot Welding of Aluminized Steel.** Harry W. Brown. *Iron Age,* v. 155, April 26, '45, pp. 56-62.

This report presents in summarized form the results of research carried on to determine the spot welding characteristics of 0.0375-in. aluminized steel. The work was done at the University of Texas as a part of the author's Master's thesis in aeronautical engineering. Shear strengths averaging 1800 lb. and higher can be consistently obtained with a tip pressure of 700 lb. and 18,000 amp., using electrodes of 2 in. dome radius. 17 ref.

22-238. **Pack-Type Emergency Cutting Outfit Developed for Shipboard Use.** *Industry & Welding,* v. 18, May '45, pp. 33-34, 75.

Development of a new oxy-acetylene emergency cutting outfit for use under battle-damage conditions. Weighs only 56 lb. and is contained in a fire-resistant canvas-back pack.

22-239. **Cutting Perfect Circles with a Cutting Torch.** Lee Brady. *Industry & Welding,* v. 18, May '45, p. 35.

Device to cut perfect circles with an ordinary cutting torch. Two methods described.

22-240. **Welding for Profit—Not for Waste.** E. E. Gentry. *Industry & Welding,* v. 18, May '45, pp. 40-41.

In putting two pieces of steel together to be welded, one of the best methods to use is the wedge method.

22-241. **Spot by Spot.** *Industry & Welding,* v. 18, May '45, pp. 44-46, 52, 54, 56-57.

Sheets to be welded must be kept scrupulously clean, electrode surfaces must be frequently cleaned of pits and strict attention to water cooling of the electrodes is another "must." Shows how the welding machine efficiency is checked and other phases of the operation.

22-242. **Tubular Section Welding.** I. A. Oehler and R. E. Goodman. *Industry & Welding,* v. 18, May '45, pp. 48-49, 90-92.

Flash welding of aircraft parts has been of special importance during the wartime emergency, since the process relieves forging and machining capacity. The tubular section welded to end fittings has a bright future in all future construction where weight is a factor.

22-243. **Basic Joint Design for Welding Process, II.** *Industry & Welding,* v. 18, May '45, pp. 60-61, 72, 74.

Basic design applied to electric arc and resistance welding.

22-244. **Some Suggestions on the Fabrication of Stainless Steel.** Paul F. Voigt. *Steel Processing,* v. 31, April '45, pp. 217-221, 237.

Stainless steels, as determined by composition and metallurgical characteristics, may be divided into three groups—austenitic, ferritic, and martensitic, the steels

in any one group being generally similar in properties. Special emphasis placed on welding the austenitic group.

22-245. **Glass-Lined Steel Fabrication.** G. L. Dawson. *Steel Processing,* v. 31, April 45, pp. 231-237.
Glass is fused directly to the steel, and might well be termed "glass-clad" steel construction, as a cross-section would be very similar to any clad steel material such as stainless clad. Problems of fabrication by welding discussed.

22-246. **Welding Insures Leak-Proof Seams in P-38 Drop Tanks.** *Steel Processing,* v. 31, April '45, pp. 240-241, 261-262.
High production rate is achieved by coordinating stationary and moving production lines. The half-shells are stamped and drawn and moved to the production area where they undergo a series of welding, assembly and finishing operations.

22-247. **Electric Brazing.** A. K. Phillippi. *Steel Processing,* v. 31, April '45, pp. 243-249.
Selection of brazing metal; brazing temperature range; heating for brazing; furnace brazing; superiority of controlled atmosphere brazing.

22-248. **Gas and Heliarc Welding of Magnesium Alloys.** F. E. Heatley. *Iron Age,* v. 155, May 3, '45, pp. 64-66.
Tests made in Heliarc and oxy-acetylene welding on currently available magnesium sheet indicate a higher percentage of efficiency for the Heliarc method.

22-249. **Power Supply for A.C. Arc Welding.** A. U. Welch and R. F. Wyer. *General Electric Review,* v. 48, May '45, pp. 41-49.
Load characteristics of this rapidly growing type of welding, and the effects that the welders have on the power-supply circuits.

22-250. **Present-Day Brazing Production Possibilities.** Arthur N. Kugler. *Machinery,* v. 51, May '45, pp. 139-148, 155.
Brazing operations outlined, which were developed under wartime conditions and indicate the wide possibilities of the process when the country returns to the fabrication of peacetime products.

22-251. **Continuous Welding of Tubular Containers.** R. V. Anderson. *Machinery,* v. 51, May '45, pp. 149-154.
How cylindrical containers are welded at a rapid rate, by a process known as "submerged melt" welding.

22-252. **The Welding of Process Piping, IV.** Arthur N. Kugler. *Heating & Ventilating,* v. 42, May '45, pp. 89-93.
Welds in all positions possible; welds to cast iron; aluminum alloys; cast iron group.

22-253. **Basic Definitions of Welding Technology.** C. H. Jennings. *Machine Tool Blue Book,* v. 41, May '45, pp. 199-200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220.

At the present time welding is accomplished in five principal ways: (1) Forge welding, (2) gas welding, (3) thermit welding, (4) electric arc welding and (5) resistance welding. Discussion is primarily concerned only with resistance welding.

22-254. **Developments in Welding Technique.** *British Steelmaker,* v. 11, April '45, pp. 178-180.
Welding various metal combinations.

22-255. **Note on Design Stresses in Class I Welded Pressure Vessels.** S. F. Dorey. Institution of Mechanical Engineers, Dec. 15, '44. *Engineers' Digest* (American Edition), v. 2, April '45, pp. 183-184.
Realization and simplification of strength formulae appears desirable. Strength of the weld should be considered as equal to the parent plate. Use of multiplying factors dependent on conditions is unnecessary.

22-256. **Helium-Shielded Arc Welding of Aluminum Alloys.** F. Masdeo. *Product Engineering,* v. 16, May '45, pp. 331-333.
Advantages of helium-shielded arc welding of low and high-strength aluminum alloys. Joint design, properties of welds, test methods and development procedure described.

22-257. **Shell Case Output Doubled by Arc Welding Procedure.** *American Machinist,* v. 89, May 10, '45, p. 115.
Savings in time, material and manpower have been accomplished by improvements in fabricating technique. Arc welding method replaces a slower and more costly production method and improves the part quality.

22-258. **Flashwelding Proves Economical in Producing Crew Nacelle Spars.** J. L. Graux. *American Machinist,* v. 89, May 10, '45, pp. 116-118.
Flashwelding equipment replaces arc welding in the fabrication of critical aircraft parts on the Black Widow plane, and the spars are 20% stronger.

22-259. **Modern Fabrication Technique.** J. A. Dorrat. Institute of Welding *Transactions,* v. 8, Feb. 15, '45, pp. 3-8.
Welded fabrications of the general type. Choice of materials; electrodes; material preparation; joint design; constructional features; forgings; steel castings; pressings; heat treatment. 3 ref.

22-260. **Symposium on Welding After the War.** Institute of Welding *Transactions,* v. 8, Feb. 15, '45, pp. 9-18.
Engineering trends, by A. Dyson. Future technique in shipbuilding, by C. S. Lillicrap. Wide scope in manufacture of pressure vessels, by H. N. Pemberton. Applications in light alloys, by H. Sutton.

22-261. **Effect of Phosphorus on the Properties and Welding Characteristics of Arsenical and Non-Arsenical Copper and on Copper-Silver Alloy Filler Rod.** Maurice Cook. Institute of Welding *Transactions,* v. 8, Feb. 15, '45, pp. 19-27, 29.
Effect of small quantities of phosphorus on the properties and welding characteristics of both ar-

senical and non-arsenical copper, and on filler rod material, the range of phosphorus contents investigated covering amounts of the deoxidant likely to be present in the metal used for welding. Mechanical properties of the two varieties of copper in the annealed and cold rolled conditions, with phosphorus contents of from nil to 0.12 %, and their work hardening and annealing characteristics investigated. 3 ref.

22-262. **System of Indicating Welding Requirements of Engineering Drawings.** H. St. G. Gardner. Institute of Welding *Transactions,* v. 8, Feb. 15, '45, pp. 38-47.

Welding requires a definite degree of knowledge and experience on the part of everyone concerned, particularly the designers and draftsmen who decide on the process to be employed, and whose duty it is to see that details appear on the manufacturing drawings stating exactly what is required. This is the main purpose of the data given although brief explanations have been advanced for some of the requirements which it is hoped will assist in its use and develop greater interest among design office staff in the practical application of the various welding processes.

22-263. **Recrystallization Welding of Aluminum Alloys: Review of Literature to December, 1943.** J. B. Wilson. Institute of Welding *Transactions,* v. 8, Feb. 15, '45, pp. 48-49.

Hammer welding; pressure welding; applications of hammer and pressure welding; welding by recrystallization. 54 ref.

22-264. **New Adhesives for Built-Up Assemblies.** G. G. Havens and George Gordon. *Product Engineering,* v. 16, May '45, pp. 289-293.

Production and properties of Metlbond adhesives, including design data on shear, tensile strength, impact and corrosion resistance, as well as experimental and service test results.

22-265. **Electric Furnace Brazing—Its Principles and Practice.** A. K. Phillippi. *Westinghouse Engineer,* v. 5, May '45, pp. 84-89.

Art of fastening materials together is a fundamental function of industry which has limited or accelerated the pace of manufacturing as the art has lagged or led industry as a whole. New electric-brazing techniques in air or controlled atmospheres provide a noteworthy advance in joining metal, performing chores on a mass-production basis not possible by the application of other methods.

22-266. **Speed Welding with the Electric Metallic Arc.** *Steel,* v. 116, May 14, '45, pp. 112, 114, 156, 158, 160.

Faster speeds give greater penetration, while the slower speeds tend to build up more of the metal on the surface. A fillet weld with greater penetration, resulting from faster travel speed, appears smaller but greater than the weld made at slow speed with a sacrifice of penetration for build-up.

22-267. **Welding Corrosion Resistant Alloys to Protect Process Equipment, and Technique of Lining Pressure Vessels.** J. A. Gallaher. *Petroleum Refiner,* v. 24, April '45, pp. 106-113.

Discusses different practices that have been used, with the thought that plant designers and fabricators may be aided in decision as to which type seems best for the equipment involved. Deals with application and welding of one group of acid and corrosion resistant alloys. Obviously, the mechanics of installing the linings would apply to any metal used for such purpose, using appropriate materials and technique for the welding. (Before the Chicago Section of the American Welding Society.)

22-268. **Welding Rod Production.** *Steel,* v. 116, April 23, '45, pp. 97-98, 140.

Manganese alloy electrodes roll into final inspection station at rate of 350 per min. in new plant. Unusual die head, new type flux press and compact seven-pass oven are features of continuous unit which completely eliminates manual handling.

22-269. **The Power-Distribution Problem in Arc Welding.** H. W. Pierce and C. E. Smith. *Electrical Engineering,* v. 64, April '45, pp. 178-184.

Discusses briefly the general principles of power distribution for arc welding and illustrates the application of these principles in the provision of an adequate, flexible, and economical distribution system in a typical shipyard.

22-270. **Portable Welding "Guns."** G. W. Birdsall. *Steel,* v. 116, April 30, '45, pp. 86-90, 134, 136.

Twenty different types of guns facilitate spot welding in otherwise inaccessible places in intricate sheet metal assemblies.

22-271. **Silver Brazing in Aircraft Production.** J. P. Weed. *Iron Age,* v. 155, May 3, '45, pp. 56-60.

Because it requires less skill and training, silver brazing is replacing gas and arc welding in the fabrication of many of the smaller aircraft component assemblies. The various methods of silver brazing currently in use and the factors making for sound assemblies.

22-272. **Arc Welding of Rail Steel.** C. B. Haynes, William H. Graft and Raymond G. Spencer. *Metal Progress,* v. 47, May '45, pp. 912-915.

Application of the common welding methods to rail steel; general belief is that high carbon steels cannot be welded successfully without preheat and stress relief. Results warrant modification of this. Rail steel, and similar high carbon steels of the section weights discussed can be welded with high heat input rates and with a good degree of success without the precaution of preheat and stress relief. The static and dynamic strength and the ductility of such weldments are quite satisfactory for many applications.

22-273. **Bending and Straightening With the Torch, II.** *Industry & Welding,* v. 18, May '45, pp. 76, 78-82.

Flame straightening cuts costs, delays, shutdowns.

22-274. **Determination of Moisture in Electrode Coatings.** G. Haim. *Iron Age,* v. 155, May 17, '45, pp. 56-58.

New method for moisture determination in arc welding electrode coatings which is claimed to be superior to other methods as regards speed and simplicity. (Reprinted from the British journal *Welding.*)

22-275. **Welding Under Water.** Edward T. Forey. *Welding,* v. 13, April '45, pp. 97-102.

Under-water arc welding for development of an important new process.

22-276. **Seam Welding.** R. W. Ayers. *Welding,* v. 13, April '45, pp. 103-110.

Electric resistance welding with rollers. Comprehensive survey of the seam welding process; describes the types of machines employed, the controls used and outlines some applications and procedures adopted.

22-277. **Oxygen Cutting of Bevels.** *Welding,* v. 13, April '45, pp. 111-114.

Bevel gage insures accuracy.

22-278. **Some Considerations in the Design of Class I Pressure Vessels.** C. J. Heeley. *Welding,* v. 13, April '45, pp. 117-124.

Characteristics of Class 1 pressure vessels, the requirements of four leading authorities, the strength of welded joints and the suitable design of such joints. (From Institution of Mechanical Engineers.)

22-279. **The Measurement of Welding.** *Welding,* v. 13, April '45, pp. 127-129.

Slide rule to simplify costing.

22-280. **New Type of Welded Truss.** *Welding,* v. 13, April '45, pp. 130-131.

Simplicity of design and easy fabrication.

22-281. **Sequence Control for Automatic Riveting.** Walter Mandel. *Automotive Industries,* v. 92, May 15, '45, pp. 42, 116, 118, 120.

Electronic sequence control unit for automatic riveting for increasing the efficiency of Model 2002 Erco riveters.

22-282. **Pressure Welding.** A. R. Lytle. *Steel,* v. 116, May 21, '45, pp. 115-116, 118, 120, 152, 154, 156, 158, 160, 162.

New oxy-acetylene method makes welds by coalescence of grains across weld interface at subfusion temperatures under controlled temperature and moderate pressure. Its efficacy as a joining medium for overland pipelines, railroad rails, oil-well tool joints, drill and spring steel, stainless, and even low carbon plate, demonstrated by results of tests and case histories reported.

22-283. **Conveyorized Welding of Hardenable Steel.** C. W. Handova. *Iron Age,* v. 155, May 24, '45, pp. 53-55, 130.

Requirements for mass production of grousers or treads for the amphibious "Water Buffalo" met by the installation of a conveyor line with eight welding stations. Passing the tack welded assemblies first through a preheating furnace solved the problem of holding the preheat temperature within a narrow range, best suited for N-A-X 9130 high tensile steel.

22-284. **Brazing Fixture Speeds Repair of Broken Milling Cutters.** *American Machinist,* v. 89, May 24, '45, p. 109.

An equalizing fixture which mates pieces properly.

22-285. **Selection and Application of Fastening Devices.** *American Machinist,* v. 89, May 24, '45, pp. 125-136.

Threads; fits; materials of manufacture; heads and recesses; studs; self-tapping and drive screws; special types of screws; machine, set and cap screws; nuts and bolts; washers; locking devices; lock nuts; lock washers; clinch nuts; preassembled bolts and washers; other locking arrangements; manufacture of threaded fasteners; tools for application; special spring-type fasteners; rivets; special rivets; quick-access fasteners; temporary fasteners.

22-286. **Magnesium Alloy Fabrication.** J. V. Winkler. *Metal Industry,* v. 66, April 27, '45, pp. 261-262.

Joining practice for magnesium alloys closely follows that for aluminum alloys, riveting being the most widely used method. High strength bonding cements may be available in the near future. (From American Society for Metals.)

22-287. **Welding Aluminum Structures.** W. J. Conley. *Modern Metals,* v. 1, April '45, pp. 14-16.

Automatic arc welding is being employed in increasing amounts in volume fabrication of aluminum structures. Method is economical and produces strong, leak-proof seams. Examples of the process.

22-288. **Gas-Shielded Arc Welding.** *Aircraft Production,* v. 7, March '45, pp. 122-125.

Survey of recent developments in the atomic-hydrogen, argon and helium-shielded processes for welding stainless steel and the light alloys.

22-289. **Spot-Welding.** *Aircraft Production,* v. 7, March '45, p. 150.

New Sciaky heavy duty equipment designed specially for light alloy work.

22-290. **Aluminum Welding by Multi-Arc.** C. W. Steward. *Aluminum & Magnesium,* v. 1, May '45, pp. 20-22, 29, 34.

Multiple arc welding makes possible the welding of some alloys previously considered unweldable, eliminates most of the objectionable features of existing processes and make possible the welding of aluminum and other non-ferrous alloys with little experience.

22-291. **Improving the Weldability of High Strength, Low Alloy Steels.** S. L. Hoyt, C. E. Sims and H. M. Banta. *Iron Age,* v. 155, May 31, '45, pp. 38-46.

Study of cracking phenomena in SAE 4130 steel suggests that the origin of cracks is associated with the chemical composition and hardenability, carbide size and distribution, the retention of austenite and subsequent transformation at or about room temperature, the absorption of sufficient hydrogen and the development of internal cooling stresses. Development of a crack-sensitivity test described and temperature-dilation curves analyzed.

22-292. **Measuring Efficiency of Training Welders.** J. B. Arthur and M. H. MacKusick. *Iron Age,* v. 155, May 31, '45, pp. 48-49, 110.

After establishing standard burn-off rates for various size arc welding electrodes, use of a consumed electrode count (stubs) gives a simple gage of arc time from which a comparative measure of efficiency can be readily calculated for individual students, teacher effectiveness and length of training time vs. tests passed. An increase of 30% in training effectiveness achieved in two months.

22-293. **Spot Welding Aluminum with Refrigerated Tips.** W. S. Simmie. *Iron Age,* v. 155, May 31, '45, pp. 55-60.

As many as 1600 spot welds were made on duralumin without redressing the refrigerated tip, but when welding DTD 390 Alclad sheet, no improvement is obtained in the amount of electrode pick-up with a refrigerated coolant. With both aluminum alloys, however, the amount of tip wear is reduced by the use of the coolant. (From *Sheet Metal Industries.*)

22-294. **Flame Cutting and Machining Methods.** Edwin Laird Cady. *Metals and Alloys,* v. 21, May '45, pp. 1313-1317.

Practical considerations, attention to which can improve the effectiveness of flame cutting and flame machining and also notably broaden their utility in any metal-working plant.

22-295. **Structural Materials.** E. F. Potter. *General Electric Review,* v. 48, June '45, pp. 7-10.

Comparison of the properties of metals used in structures fabricated by welding.

22-296. **Reclamation of Magnesium Castings by Helium Arc Welding.** B. L. Averbach. *Metal Progress,* v. 47, June '45, pp. 1137-1139.

Salvage of magnesium castings by the helium arc process; experimental work on salvage which helped out when starting to reclaim minor defects.

22-297. **Soft Solders.** L. G. Earle. *Metal Industry,* v. 66, May 18, '45, pp. 308-311.

"Jointing capacity" may be analyzed into two independent characteristics of the soldering system: Its time-temperature-wetting characteristic and its interfacial-tension characteristic. An apparatus for measuring these two independent characteristics is described. (Institute of Metals.) 2 ref.

22-298. **Failures in Steel Fabrication.** R. V. Anderson. *Welding Engineer,* v. 30, May '45, pp. 35-37.

Metallurgist can diagnose the cause of failure of a steel structure. Failures leave telltale evidence such as grain structure, deformation, notch-effect nucleus, etc.

22-299. **Welded Handling Equipment.** Walter J. Brooking. *Welding Engineer,* v. 30, May '45, pp. 38-41.
Transportation of parts and assembled units inside the factory requires as much planning as the actual manufacturing.

22-300. **Building Ships Indoors.** T. B. Jefferson. *Welding Engineer,* v. 30, May '45, pp. 42-43.
LCM-3s turned out two a week in Armco's unique indoor shipyard, which occupies less than a third of an acre. Jigs and positioners skillfully used.

22-301. **Jobs in a Job Shop.** R. Brogne. *Welding Engineer,* v. 30, May '45, p. 47.
Everything from repair of cracked engine blocks to the building of a 75-ton hydraulic jack.

22-302. **Preparation for Spot Welding.** B. F. Dunlap. *Welding Engineer,* v. 30, May '45, pp. 48-49.
Aluminum alloy parts cannot be satisfactorily spot welded without surface cleaning and oxide removal. Best ways of cleaning. Tried and tested procedure.

22-303. **Flame-Cutting Guide.** R. P. Monroe. *Welding Engineer,* v. 30, May '45, p. 50.
Shape flame-cutting with a portable machine.

22-304. **Weldor's Flash—Its Causes and Cure.** Joseph S. Wright. *Welding Engineer,* v. 30, May '45, pp. 52, 54.
Presence of large numbers of weldors in shipbuilding and other war industries has created a new industrial hazard—weldor's flash.

22-305. **Volts for Vertical Welding.** Charles P. Kelley. *Welding Engineer,* v. 30, May '45, p. 56.
Concise explanation of the various factors involved. Why high open-circuit voltages should be used to do vertical welding.

22-306. **Flash Welding in Metal Fabrication.** H. J. Malee and Gilbert C. Close. *Finish,* v. 2, June '45, pp. 13-16, 50.
Recent developments.

22-307. **Silver Brazed Joints in Severe Service.** R. T. Jones. *Product Engineering,* v. 16, June '45, pp. 412-414.
Considerations in designing joints for silver brazing presented on the basis of experience with military equipment in which severe service conditions such as shock loads, vibrations, and corrosion are successfully resisted.

22-308. **Removing Risers and Padding by Machine Flame Cutting.** R. J. Wolf and J. H. McKlveen. *Foundry,* v. 73, June '45, pp. 92-94, 234-236.
Removing heads and padding on steel castings and a solution presented in the form of oxy-acetylene machine flame cutting

22-309. **New Oxy-Acetylene Methods Speed Mass Production.** J. S. Johnston. *Production Engineering and Management,* v. 15, June '45, pp. 90-94.

Special-purpose machine developed for the pressure welding of liquefied gas cylinders. Application indicates the trend toward use of mechanically controlled equipment for repetitive operations in pressure welding.

22-310. **Back-Pack Oxy-Acetylene Cutting Outfit.** *Steel,* v. 116, June 4, '45, pp. 107, 144.

Developed to speed repair of Navy's battle-damaged ships, may find many postwar industrial applications. Light weight of portable pack permits operator to carry it through narrow passages.

22-311. **Problems in Weld Preparation.** *Industry & Welding,* v. 18, June '45, pp. 34-37, 94-98.

Whatever the application, quality work in welding is essential. Proper preparation and working conditions often are the key to this. Prevention of errors in welding being much less costly than a pound of cure, continuous consideration should be given as to how such common errors in procedure can be overcome and eliminated.

22-312. **Are You Using Carbon Arc Welding?** *Industry & Welding,* v. 18, June '45, pp. 52-56, 59-60.

Carbon arc welding is a highly efficient process for the fabrication and repair of special alloys and non-ferrous materials. Requires consideration of arc length, curve values, speed of travel and welding set-up. Standard equipment used; the carbon is connected to the negative pole of the welding machine.

22-313. **Tubular Section Welding.** *Industry & Welding,* v. 18, June '45, pp. 62, 64.

Tubular section welded to end fittings in the aircraft industry. Flash weld is a forged weld, the pieces to be welded rigidly clamped in dies and placed in an electric circuit in such manner that a multitude of fine arcs or flashes occur and heat the surfaces to be joined.

22-314. **Proper Resistance Welding Set-Ups for Ferrous and Non-Ferrous Metals—I.** F. R. Woodward. *Industry & Welding,* v. 18, June '45, pp. 66-75.

Analysis and physical characteristics of a material to be joined by resistance welding will give the correct set-up values for the welding machine. Low carbon steel discussed.

22-315. **Improving the Weldability of High Strength, Low Alloy Steels.** S. L. Hoyt, C. E. Sims, and H. M. Banta. *Iron Age,* v. 155, June 7, '45, pp. 70-76.

Report on the effect of aluminum and titanium upon the crack sensitivity of SAE 4130 steel. Effect of titanium and carbide size on the crack sensitivity properties of NE 8635 steel.

22-316. **All-Welded Composite Steel Beam and Concrete Slab Bridges.** Glenn L. Enke. *Welding Journal,* v. 24, May '45, pp. 435-444.

Shows that an all-welded composite steel beam and concrete slab bridge in the 60-ft. span range will save nearly 19% of the cost of the ordinary type of steel beam and concrete slab bridge, which does not utilize the concrete slab to resist stress, and that an all-riveted design can hardly justify the use of the slab in a composite girder section, as the high cost of providing a riveted shear key between slab and girder absorbs all but 3% of the saving.

22-317. **How to Make Cutting Machine Templets.** Rudolph Chelborg. *Welding Journal,* v. 24, May '45, pp. 444-447.

High degree of accuracy is easily obtained in parts shape-cut by the use of templets. Operator must understand principles of preparing the templets for use. Careful workmanship is important because any inaccuracy in the templet will be imparted through the cutting blowpipe to the shape being cut.

22-318. **Low-Temperature Joining.** R. D. Wasserman and Clinton E. Swift. *Welding Journal,* v. 24, May '45, pp. 449-454.

Low temperature welding supplements soldering, brazing and fusion welding without any of their disadvantages. Advantages of brazing inspired the research work which resulted in the development of the low temperature welding process.

22-319. **Flash Welding 4130 Steel.** W. W. Ackerman and Walter Pestrak. *Welding Journal,* v. 24, May '45, pp. 463-467.

Advantages of the flash-welded joint over the fusion-welded joint are better physical characteristics; lower weights; cheaper and faster production with less operator skill; no warping as a result of welding; less brittleness at low temperatures; higher fatigue strength.

22-320. **Joint Design for Silver Brazing Non-Ferrous Metals.** G. H. Bohn. *Welding Journal,* v. 24, May '45, pp. 467-470.

Joints brazed with the oxy-acetylene blowpipe discussed.

22-321. **Strength of Welded Ships.** R. T. Young. *Welding Journal,* v. 24, May '45, pp. 471-474.

Ship stresses; effect of design on stresses; ship fractures; stress concentrators; quality of steel; location of fractures; some disadvantages of the welded ship.

22-322. **Model Tests of Weld Reinforcements for the Hatch Corners of Welded Ships.** G. L. Smith. *Welding Journal,* v. 24, May '45, pp. 257s—267s.

Tests with model plates to determine the effect of diagonal welded beads or straps applied to deck plating near the corners of hatch openings on ships. Tensile strains can be introduced into the material at the corners of an opening in a plate to prevent a crack from starting at the corner under over-all tensile load or to delay the starting of a crack at a sharp corner until the ultimate strength of the material has been reached.

22-323. **Electronic Flame Cutter.** *Steel,* v. 116, May 28, '45, pp. 102-104, 144.
Radically new system for guiding cutting torches on contour work on steel plate employs plastic records inscribed with full instructions in series of vertical white dashes. "Played back" on machine, and picked up by photoelectric cell actuated by light or projector lamp, records accurately control through drive motors transverse and longitudinal movements of torches.

22-324. **Automatic Arc Welding Air Compressor Tanks.** *Steel,* v. 116, May 28, '45, pp. 116, 118.
Speeds up to 36 in. per min. and 100% penetration with no edge preparation. Carriage-mounted automatic head on beam is rapidly positioned over seam; special fixture, powered by exciter of welding generator, automatically rotates assemblies to be welded.

22-325. **Welding Various Metal Combinations with the Electric Arc.** O. M. White. *Metallurgia,* v. 31, April '45, pp. 299-300.
Weld joining two metals will be of composite make-up, due to the dilution or in-wash of one metal by the other. Physical characteristics of this hybrid weld must be carefully considered in relation to the base metals. The heat effect of welding also affects results. A third metal, deposited as a transition bead, may be used, and its effects must also be considered.

22-326. **Application of Arc Welding to Machine Tool Production.** H. A. *Machinery* (London), v. 66, April 26, '45, pp. 451-454.
Description of methods employed.

22-327. **Alloys for Soft Soldering.** J. C. Chaston. *Metal Treatment,* v. 12, Spring '45, pp. 19-22.
Need for economy in tin has spurred on research into every aspect of solders and soft soldering, and the results are summarized from a number of recent publications. 6 ref.

22-328. **Resistance Welding Equipment Designed for Production.** *Metal Treatment,* v. 12, Spring '45, pp. 64-65.
Electrical control; welding pressure; welding machine as a unit.

22-329. **Observations on the Appearance Welding of Malleable Castings.** H. A. Schwartz, Ira Young, and James Hedberg. American Society for Testing Materials, Preprint 31, 9 pp.
Repair, by welding, of surface defects. Purpose has been to indicate the microstructure which might be expected from various techniques and to investigate those techniques involving a short post heat treatment in comparison with the more established practice of welding with hard iron completely reannealed.

22-330. **Good Welds in Magnesium Made by the Heliarc Process.** F. Masdeo. *American Machinist,* v. 89, June 7, '45, pp. 126-129.
Practical pointers for welding by this method; what results may be anticipated.

22-331. **A Note on the Forge Welding of Silver.** A. G. Dowson. Institute of Metals *Journal,* v. 71, April '45, pp. 205-212.

Laboratory experiments designed to determine the conditions under which satisfactory pressure or forge welds can be made in pure silver sheet described, and the application of the results of these tests to the successful production of a vessel lining difficult to fabricate by other means outlined.

22-332. **Development and Future of Resistance Welding.** H. C. Cogan. *Steel,* v. 116, June 11, '45, pp. 125, 172, 174.

Research has smoothed the course so that procedures now follow known laws. "Off the shelf" equipment affords pressure ranges from as little as 3 oz. to 300,000 lb. Power load problem solved.

22-333. **Improving the Weldability of High Strength, Low Alloy Steels.** S. L. Hoyt, C. E. Sims, and H. M. Banta. *Iron Age,* v. 155, June 14, '45, pp. 74-80, 148.

Crack-sensitivity of SAE 4130 steel is improved with increases in sulphur content because of its secondary effects. Study of post heating indicates that the conditions that give the most favorable results are those corresponding to the conditions in the S-curve which are most favorable to the formation of bainite.

22-334. **Welded Airscrew Hubs.** *Aircraft Production,* v. 7, May '45, pp. 210-215.

Report and survey of the comparatively new flash-butt welding process of producing hubs for the company's well-known airscrews. It shows that considerable material and time economies have been effected by the new technique.

22-335. **Welded Stainless Steel Tubing.** *Heating and Ventilating,* v. 42, June '45, pp. 75-77.

Electric welded stainless steel tubing for pipe lines carrying active chemical solutions. Tubing is made by passing flat-rolled steel through a series of forming rolls which form it into a cylinder and press the edges into contact. Then heavy current flows through the metal, welding the seam and forming a solid wall without the addition of any extraneous metal. The result is tubing with all the inherent advantages of flat-rolled stainless steel plus a weld as strong and corrosion resistant as the rest of the wall.

22-336. **Welding and Brazing Technics in the Electronic Tube Industry.** I. S. Goodman. Electrochemical Society Preprint 29, 14 pp.

Methods of welding and brazing in the electronic tube industry described. Factors which influence the technique discussed: Necessity for vacuum-tight joints; high temperature operation of most electronic tubes; refractory metals which form the structural elements of the tubes; and the extensive use of glass members. Commoner brazing alloys described and tabulated.

22-337. **Applications of Various Resistance Welding Techniques.** F. R. Woodward. *Steel Processing,* v. 31, May '45, pp. 305-309, 316-318.

Product design considerations; seam welding; welding set-up; seam welding machines; seam welding electrodes; intermittent seam; butt seam; machine maintenance; projection welding; types of machines; butt welding; flash welding; materials to be welded; projection, butt, flash welding; wrought iron; low alloy steels; alloy steels; stainless steels; welding of dissimilar materials.

22-338. **Soft Solders.** L. G. Earle. *Metal Industry,* v. 66, May 25, '45, pp. 322-325.
Concept of zero M.E.W.T. and gives graphs and values showing the effects of variations in composition and flux on the wetting power of solders for a range of materials.

22-339. **Control of Automatic Welding Processes.** A. E. Bedell and J. B. Quigley. *Canadian Metals and Metallurgical Industries,* v. 8, May '45, pp. 36-39.
Discussion confined to automatic machine welding processes suitable for heavy plate fabrication of mild and certain alloy steels. (Paper for American Welding Society, Oct. 1944.)

22-340. **Use and Evaluation of Some Specialty Adhesives.** Fred Wehmer. *Mechanical Engineering,* v. 67, June '45, pp. 380-382.
Methods of testing bond strength; service-type test for adhesives; specialty uses for adhesives.

22-341. **Welded Bombs for Insects.** *Welding Engineer,* v. 30, June '45, p. 75.
Welding is indispensable to a dispenser for a new insecticide—a "bomb" to kill the pests that spread yellow fever and malaria.

22-342. **Welded Handling Equipment, Part 2.** Walter J. Brooking. *Welding Engineer,* v. 30, June '45, pp. 54-56.
Transportation of parts and assembled units inside the factory requires skillful planning. How welding is used to fabricate a wide variety of steel units for handling materials.

22-343. **Power Systems for Resistance Welding.** J. H. Cooper. *Welding Engineer,* v. 30, June '45, pp. 57-58, 60, 62.
Analysis which will help those who would like to familiarize themselves with the various electrical systems for resistance welders and their applications.

22-344. **All-Welded Invasion Barges.** William A. Springer. *Welding Engineer,* v. 30, June '45, pp. 51-53.
An inland shipyard; carried by cranes; first station assembly; hull now reversed; naval inspection; train own weldors; plant and equipment; other war materiel.

22-345. **Welding for the Armed Forces.** R. G. Alison. *Welding Engineer,* v. 30, June '45, pp: 48-50.
Weldors in the Canadian army face problems similar to those our own G. I. weldors encounter. First-hand account by a man who spent seven months with the Canadian forces in England, visiting various workshops.

22-346. **Welded Hydraulic Presses.** Clyde B. Clason. *Welding Engineer,* v. 30, June '45, pp. 39-43.

War brought a terrific demand for hydraulic presses. Welding, called in as an auxiliary fabrication method, made it possible to meet critical delivery dates.

22-347. **An Analysis of Hard - Facing.** Fred M. Burt. *Welding Engineer,* v. 30, June '45, pp. 44-47.

Predicts that the use of hard-facing today is as a mere child compared to what it will be when the process is better known and more widely accepted.

22-348. **Mechanized Arc Welding.** *Steel,* v. 116, June 18, '45, pp. 110-112, 154, 156.

Factors to take into consideration: Welding the complicated shape involving locked up stresses in the weld; metallurgical problem of arc welding a 0.30% carbon alloy of self-hardening steel. A heat treating factor and resulting warpage, plus additional warpage from a descaling operation, enter as production problems.

22-349. **The Welding of Non-Ferrous Metals, IV.** E. G. West. *Sheet Metal Industries,* v. 21, May '45, pp. 871-874.

Summary of gas welding processes.

22-350. **Welding Aluminum and Aluminum Alloys.** A. J. T. Eyles. *Sheet Metal Industries,* v. 21, May '45, pp. 875-880.

Type of flame needed; welding rods; fluxes and fluxing; preparation for welding; various types of joint; welding technique; arc welding; preparation of the edges; welding procedure; speed of welding; slag and flux removal.

22-351. **Cutting With Propane.** *Production and Engineering Bulletin,* v. 4, May '45, pp. 164-165.

Use of propane or coal gas advocated as a substitute for acetylene in welding and cutting. Report gives practical guidance as to the scope of propane in flame cutting.

22-352. **Investigation of Bonding in Cylindrical Cast of Bonded Metal Part (Steel-Copper Alloy).** G. Vogt. *Metall Wirtschaft,* v. 22, Dec. 20, '43, pp. 553-556.

22-353. **Deep Penetration Welding.** H. Martin. *Welding,* v. 13, May '45, pp. 140-146.

Technique and applications.

22-354. **Some Considerations in the Design of Class 1 Pressure Vessels.** E. J. Heeley. *Welding,* v. 13, May '45, pp. 147-153.

Characteristics of Class 1 pressure vessels, the requirements of four leading authorities, the strength of welded joints and the suitable design of such joints. (Institution of Mechanical Engineers.)

22-355. **Manual Carbon Arc Welding.** P. L. Pocock. *Welding,* v. 13, May '45, pp. 154-163.

Investigations carried out on different materials and with different joints. Results tabulated.

22-356. **Cast Iron Fusion Welding.** J. K. Johannesen. *Welding,* v. 13, May '45, pp. 167-172.

For maintenance and repair work.

22-357. **Releasable Fuel Tanks.** *Welding,* v. 13, May '45, pp. 173-175.
Production by seam and roller-spot welding.

22-358. **Gas Welding of Mild Steel Plate.** W. Norton Crampton. *Welding,* v. 13, May '45, pp. 176-177.
Penetrational fusion.

22-359. **An Analysis and Comparison of Various Resistance Welding Systems.** R. L. Longini. *Welding Journal,* v. 24, June '45, pp. 535-538.
Compares all aspects of the non-energy storage systems.

22-360. **Resistance Welding Progress.** J. W. Meadowcroft. *Welding Journal,* v. 24, June '45, pp. 538-539.
Review.

22-361. **Application and Development of Modern Heavy-Coated Arc-Welding Electrodes.** D. C. Smith and W. G. Rinehart. *Welding Journal,* v. 24, June '45, pp. 541-548.
Influence of coating materials on the arc energy distribution; welding slag; Group I—E6010 and E6011; Group II—E6012 and E6013; Group III—E6020 and E6030; new high-tensile ferritic electrodes. 3 ref.

22-362. **Basic Definitions of Welding Technology.** C. H. Jennings. *Welding Journal,* v. 24, June '45, pp. 549-553.
Forge welding, gas welding, thermit welding, electric arc welding and resistance welding defined.

22-363. **Silver Brazing by Induction Heating.** J. P. "Mike" Weed. *Welding Journal,* v. 24, June '45, pp. 553-556.
Study of the possibilities of the use of silver brazing in aircraft assemblies resulted in the redesign of some assemblies and the procurement of additional equipment for automatically or semi-automatically controlled heating.

22-364. **Spot Welding Machines for Heavy Gages of Ferrous and Non-Ferrous Metals.** Mario Sciaky. *Welding Journal,* v. 24, June '45, pp. 557-563.
Design of resistance-welding machines as affected by the welding of heavy gages of steel and aluminum sheets; welding of scaly steel with conventional machines; variable pressure cycle; three-phase welding machines; principle of operation; method of operation; stored energy welding machines for heavy gages of aluminum; welding machines for heavy gages of steel; spot welds; use of spot welding as compared to arc welding.

22-365. **Welding Railroad Structures.** T. H. Gardner. *Welding Journal,* v. 24, June '45, pp. 563-564.
Use of welding in the strengthening, or reinforcement, of bridge structures provides for the economical replacement of lost metal due to corrosion, or the placing of additional metal to increase the capacity of structures. Proper procedure of the welding may have to be deviated from in order to secure proper fusion and penetration of the parent metals of different characteristics.

22-366. **Efficiency and Production Control of Training Personnel for Manual Arc Welding.** J. B. Arthur and M. H. MacKusick. *Welding Journal,* v. 24, June '45, pp. 565-566.

Training for welding work is a production job. Start with raw material, process, inspect and turn out the product. Method of processing depends upon minimum production requirements for student welders after leaving formal training; money allocated to formal training of operators; operator qualification requirements.

22-367. **The Weld Stress Problem.** *Welding Journal,* v. 24, June '45, p. 313s-319s.

Weldability problem; weld stress problem.

22-368. **Control of Distortion in Arc Welding.** J. R. Morrill. *Iron Age,* v. 155, June 28, '45, pp. 77-80.

Three simple rules for controlling distortion interpreted in terms of specific "do's" and "dont's."

22-369. **Application of Cold Driven Riveting Process.** H. G. Debald. *Fasteners,* v. 2, no. 2, '45, pp. 14-15.

Cold driven rivets used in the fabrication of many structures for flood control projects, with very satisfactory results.

22-370. **Riveted Fabrication Used for Long Span Girders of Foster's Ferry Bridge in Alabama.** W. N. Woodbury. *Fasteners,* v. 2, no. 2, '45, pp. 16-18.

Of riveted construction throughout, Foster's Ferry Bridge over the Black Warrior River near Tuscaloosa, Ala., represents a fine solution of a difficult problem in roadway grades and economic spacing of piers.

22-371. **Brazing With Electric Induction Heat.** A. M. Setapen. *Steel,* v. 117, July 2, '45, pp. 92-95, 130, 132, 134, 136, 138.

Describes in detail how to join parts with silver-base alloys.

22-372. **Soldering Aluminum.** *Automobile Engineer,* v. 35, May '45, pp. 193-195.

Soldering alloys; soldering fluxes; removal of flux after soldering; soldering methods; practical hints on soldering aluminum; mechanical properties of soldered light alloy joints. 5 ref.

22-373. **Resistance Welding Aluminum.** E. T. Hughes. *Light Metal Age,* v. 3, June '45, pp. 12-14.

Methods and equipment used in resistance welding of aluminum. Recommendations are made for obtaining best results. 7 ref.

22-374. **Cutting Metal With the Electric Arc.** *Modern Machine Shop,* v. 18, July '45, pp. 138, 140, 142, 144, 146.

How to cut rivet heads or pierced holes with arc welder.

22-375. **Welding and Brazing of Stamped Parts.** *Western Machinery & Steel World,* v. 36, June '45, pp. 264-266.

Pressed metal manufacturers may select one of several methods of joining for the particular job. Welding may be accomplished by either electric or gas, manual or automatic procedure. Two types of brazing may be employed—low temperature atmospheric brazing and high temperature controlled atmosphere brazing. All are discussed.

22-376. **Silver-Brazing Production Methods at North American.** Ralph H. Ruud. *Machinery,* v. 51, July '45, pp. 162-169, 201.

Induction heating, gas furnace, and hot dipping methods are all employed by a concern that has established a reputation for high quality brazed work.

22-377. **Heliarc Welding of Aircraft Fuel Tanks.** W. S. Evans. *Machinery,* v. 51, July '45, pp. 170-177.

How engineers of the Curtiss-Wright Corp. solved the problem of designing and fabricating leakproof aluminum alloy fuel tanks for transport planes.

22-378. **Use of Metallic Arc Welding in Fabricating Pressure Vessels.** Charles M. Scudder and John J. Chyle. *Railway Mechanical Engineer,* v. 119, July '45, pp. 288-291.

Many steps in building of unfired vessels by welding applicable to locomotive boilers—good engineering and shop practice essential.

22-379. **Fabrication of Gondolas.** *Railway Mechanical Engineer,* v. 119, July '45, pp. 283-285, 291-292.

50-ton all-purpose composite gondolas are built by welding at the Milwaukee shops. Production is eight cars a day.

22-380. **Observations on the Appearance Welding of Malleable Castings.** H. A. Schwartz, Ira Young, and James Hedberg. American Society for Testing Materials, Preprint 31, 1945, 9 pp.

Repair, by welding, of surface defects. Within the limitations of this paper, such welds need be ductile enough to permit of very moderate deformation and soft enough to permit machining at speeds comparable with those used on malleable iron. Reference to commercial machining on welds made by a promising technique.

22-381. **Phototube-Controlled Flame Cutter.** David S. Walker. *Electronics,* v. 18, July '45, pp. 100-103.

Electronic control makes possible accurate oxy-acetylene cutting of large steel sheets on a mass production basis, using photo-electric scanning of small master drums in place of conventional contour tracing of costly full-size master patterns.

22-382. **Elongation in Aircraft Spars Caused by Riveting Operations.** C. H. Smith. *Product Engineering,* v. 16, July '45, pp. 471-473.

Effects of drilling, rivet expansion and pressure of heading on the misalignment of holes and the elongation in long aircraft spars for different ratios of rivet length to diameter and different thicknesses of material. When material thickness is small in comparison

with rivet diameter, tests show that the elongation is not related to material thickness.

22-383. **Strength of Spot Welds in 75S Aluminum Alloy.** *Product Engineering,* v. 16, July '45, p. 484.

Spot welding tests by Consolidated Vultee Aircraft Corp. on 75S aluminum alloy after both solution heat treatment (the "W" condition), and after complete heat treatment (the "T" condition), show that satisfactory welds with consistent strength can be made without establishing optimum welding machine settings for different gages of material.

22-384. **The Welding of Non-Ferrous Metals, Part 5.** E. G. West. *Sheet Metal Industries,* v. 21, June '45, pp. 1057-1063.

Arc welding processes.

22-385. **A Summary of Observations of Cracking in Spot Welds in Alclad 24S-T.** Robert A. Wyant. *Sheet Metal Industries,* v. 21, June '45, pp. 1067-1068, 1072.

Summarizes the information on cracking that has been more fully discussed in the progress reports from the laboratory. (From *Welding Journal.*)

22-386. **Flash and Butt Welding Light Gage Ferrous and Non-Ferrous Metals.** T. Watson and A. J. Hipperson. *Welding,* v. 13, June '45, pp. 188-197.

Details of a recently established method which has been found completely efficient. Flash-butt welding of light gage steel and development work on thin sections of brass. 2 ref.

22-387. **A Welding Repair Business.** E. H. Christie. *Welding,* v. 13, June '45, pp. 210-213.

How it can be started today. Licenses; plant required; accessories; capital required; business procedure and records; assessment of overheads; welding repair to casting; job cards.

22-388. **Merchant Shipbuilding.** Amos L. Ayre. *Welding,* v. 13, June '45, pp. 214-216.

Expanding use which has been made of welding in the construction of merchant vessels.

22-389. **Multi-Storey Buildings.** J. Corston Mackain. *Welding,* v. 13, June '45, pp. 217-223.

Extensions to present constructions. Explains how welding was used to carry out vertical extensions on an existing building.

22-390. **Welding of Thin Gage Sheet.** H. W. Dear. *Welding,* v. 13, June '45, p. 223.

Method adopted to reduce distortion.

22-391. **Welding Aluminum-Magnesium Alloys.** W. K. B. Marshall. Institute of Welding *Transactions,* v. 8, May '45, pp. 53-57.

Experiences in solving one specific problem which was met in welding 3% magnesium alloy. It is a problem which may be encountered in any fabricating process in which working and annealing is followed by welding.

22-392. **Hard Surfacing by Welding.** Maurice Riddihough. Institute of Welding *Transactions*, v. 8, May '45, pp. 58-62.

Outlines the types of alloy rod called for by major industries and the conditions they encounter in service. The available hard-facing alloys are grouped in four headings: under 20% alloy, more than 20% alloy, non-ferrous alloys, tungsten carbides; typical analyses are given. The technique of hard-facing is discussed in relation to cracking and deformation and detailed heat treatment recommendations are given for most types of steel. 5 ref.

22-393. **Application of Welding to Steel Structures.** R. G. Braithwaite. Institute of Welding *Transactions*, v. 8, May '45, pp. 63-67.

Properly designed welded structures will show a saving of from 15 to 20% of the weight of similar riveted structures but the cost rarely shows more than 5% saving, and in many cases the work is actually dearer. While the general design of the structures has been sound in conception, the economy has been lost through the incorrect treatment of the joints. Discusses some joint details from the point of view of the fabricator.

22-394. **Influence of Sulphur and Phosphorus on Weldability of Mild Steel.** L. Reeve. Institute of Welding *Transactions*, v. 8, May '45, pp. 80-88.

Cracking in the weld during welding of mild steel is sometimes encountered, and has been attributed both to the steel and the electrode. Reports certain observations on the influence of sulphur, phosphorus, and, to a lesser extent, carbon, on the cracking tendency of mild steel weld metal, and the influence of the type of electrode on this phenomenon. 13 ref.

22-395. **Testing Welded Structures by the Tee-Bend Test.** Leon C. Bibber and Julius Heuschkel. *Steel*, v. 117, July 16, '45, pp. 124, 126, 164, 166, 168, 170, 173.

Performance of the toes of fillet welds under severe concentrations of stress in the tee joint is studied in the laboratory by an improved tee-bend test which simulates severe conditions such as encountered by welded ships.

22-396. **Resistance Welding Laboratory Facilities.** R. T. Gillette. *General Electric Review*, v. 48, July '45, pp. 26-29.

How a manufacturer benefits by having his own laboratory. Types of equipment needed.

22-397. **Self-Forging Welder.** C. H. Strange. *Electronic Industries*, v. 4, July '45, pp. 109, 166, 170.

Damped oscillatory discharge using air core welding transformer prevents residual magnetism difficulties.

22-398. **Some Safety Factors in Arc Welding.** R. F. Wyer. *Railway Engineering and Maintenance*, v. 41, July '45, pp. 670-673.

Hazards involved and the safety practices that should be observed in arc welding work. Also explains that, contrary to popular belief, arc welding is

not a hazardous occupation, if the work is done in accordance with sound safety rules.

22-399. **Electronics—Welding Control.** Clark E. Jackson. *Modern Metals,* v. 1, July '45, pp. 20-21, 23.

Outlines different types of welding and some of the factors contributing to efficient operation.

22-400. **Brazing.** Lawrence D. Jennings. *Aircraft Production,* v. 7, June '45, pp. 294-296.

Types of points and processes.

22-401. **Electronic Control.** *Aircraft Production,* v. 7, June '45, pp. 261-265.

Application of electronic control to two sheet metal joining processes — electric resistance welding and riveting—is briefly reviewed and an indication given of its advantages in the automatic control and coordination of variable factors.

22-402. **Designing of "Trouble-Free" Dies, XLVIX.** C. W. Hinman. *Modern Industrial Press,* v. 7, June '45, pp. 22, 30.

Welding for the war and peace.

22-403. **Building-up and Hard Surfacing by Welding.** William Andrews. Institution of Mechanical Engineers *Journal,* v. 152, June '45, pp. 1-4.

Describes the process of using fusion welding for renewing worn or corroded parts and points out that it can equally well form part of the original design for many structures. Characteristics of the various welding processes are considered from the point of view of the materials with which they may be concerned, and the features of the metallic arc process are considered in some detail. Some illustrations of the type of weld deposit practicable are considered, and the more limited developments in the non-ferrous metals and "super-hard" alloys are referred to. 10 ref.

22-404. **Flash Welding Rings.** I. A. Oehler and Robert E. Goodman. *Welding Engineer,* v. 30, July '45, pp. 44-47.

American Welding Co. specializes in the fabrication of steel rings and bands, flash-butt welded on controlled welders. Developed many interesting techniques to insure customers fast production and high quality.

22-405. **Pipe Lines for "Pluto".** *Welding Engineer,* v. 30, July '45, pp. 49-51.

Ingenuity in the design of "Hais" cable and "Hamel" welded steel pipe for Operation Pluto—pipe lines under the ocean.

22-406. **America's Answer—the JB-2.** T. B. Jefferson. *Welding Engineer,* v. 30, July '45, pp. 52, 54, 56.

Buzz bombs being built in America. Nazi V-1 was an excellent product, but the all-welded engine of the JB-2 is even better.

22-407. **Lightweight Indexing Fixture for Automatic Riveting.** G. F. Gerhauser. *Tool Engineer,* v. 14, June '45, pp. 44-45.

Standardized fixtures broaden work range of automatic, single purpose production machines.

22-408. **Fundamental Data on Oxy-Acetylene Cutting Technique.** G. V. Slottman. *American Machinist,* v. 89, July 19, '45, pp. 99-101.

Practical applications of flame cutting have led to refinements which embrace preheating of the metal and improvements in the design of torch tips. Reviews developments in flame cutting.

22-409. **Oxy-Acetylene Welding of Steel Plate.** *Industry & Welding,* v. 18, July '45, pp. 30-32.

Preparation of metal and torch application in the fusion of mild carbon plate welds.

22-410. **Furnace Brazing.** H. G. Telford. *Industry & Welding,* v. 18, July '45, pp. 34-36.

Design of the article to be fabricated. Suitable alloy, furnace, plant facilities, all are prime factors in plotting the potential profit and volume of production by use of the furnace brazing process.

22-411. **Proper Resistance Welding Set-Ups for Ferrous and Non-Ferrous Metals, II.** F. R. Woodward. *Industry & Welding,* v. 18, July '45, pp. 63-66.

Following an analysis of the physical characteristics of the materials to be joined by resistance welding, consideration may be given to "weld time," pressures and other factors governing the quality of the weld.

22-412. **Cost of Refacing Worn Car Wheel Flanges Reduced by 50%.** Fred Strawbridge. *Industry & Welding,* v. 18, July '45, pp. 96, 98-99.

Simple, layer-on-layer arc welding process accounts for a 50% saving in the cost of refacing abrasion-worn flanges of car wheels.

22-413. **Welding the Weasel.** Clyde B. Clason. *Welding Engineer,* v. 30, July '45, pp. 40-43.

The Weasel is all-welded, and all welding processes are required for its manufacture.

22-414. **Resistance Welding With Storage-Battery Power.** G. W. Birdsall. *Steel,* v. 117, July 23, '45, pp. 112-113, 158, 160, 162, 164.

Use of special storage batteries and direct control of large welding currents are expected to expand greatly field of spot, seam, flash, butt and upset or "forge" welding, for these advances no longer limit welding currents to those available from the power system serving the plant.

22-415. **Fabrication as a Substitute.** H. G. W. *Machinery* (London), v. 66, June 21, '45, pp. 683-685.

Welding and casting methods compared; the correct approach; typical examples; welded jigs; power presses; stress relieving.

22-416. **Welding Manganese Castings in Special Trackwork.** *Railway Engineering and Maintenance,* v. 41, Aug. '45, pp. 781-783.

In 1942 and 1943 a number of manganese test frogs were repaired by arc welding using various methods

and materials, and were later supplemented by a series of laboratory studies. Presents a background of these tests and a series of tentative conclusions based on them.

22-417. **The Technical Control of Resistance Welding.** H. E. Lardge. *Sheet Metal Industries,* v. 22, July '45, pp. 1241-1246.

How control of welding can be achieved through a welding technical department.

22-418. **The Welding of Non-Ferrous Metals. Part V.** E. G. West. *Sheet Metal Industries,* v. 22, July '45, pp. 1247-1252, 1256.

Manipulation; carbon-arc welding; atomic hydrogen welding; argon-arc welding; heliarc welding; the Weibel & Rakos processes; protection of operators. 7 ref.

22-419. **Shaped Guides Increase Accuracy in Manual Torch Operations.** G. V. Slottman. *American Machinist,* v. 89, Aug. 2, '45, pp. 114-117.

Knowledge of cutting drag is important in hand operations. Pointers on hand flame cutting.

22-420. **Aids to Riveting.** *Aircraft Production,* v. 7, July '45, pp. 321-322.

Consolidated Vultee equipment; reaction riveting; rivet dispenser; rivet extraction.

22-421. **1945 Specifications for Metallic Arc Welding Electrodes.** Orville T. Barnett. *Steel,* v. 117, Aug. 6, '45, pp. 112-115.

Specification for mild steel and low alloy electrodes permits consumers to make rigid and complete demands on manufacturers. Guide to classification and reiteration of rule specifying single assignment of grade numbers are worthwhile additions to data.

22-422. **Boost Boiler Welding Speed.** George Bain. *Industry and Power,* v. 49, Aug. '45, p. 76.

Modern process of automatic welding permits higher welding speeds and increased production per manhour of welding.

22-423. **Induction Brazing and Soldering.** H. U. Hjermstad. *Iron Age,* v. 156, Aug. 9, '45, pp. 56-60.

High frequency induction heating can be fully controlled to carry out low temperature brazing and soldering without damage to surfaces or components within containers. Permits salvaging of cutting tools with minimum effects on hardness.

22-424. **Gas Cutting of Stainless Aided by Fluxing System.** *Iron Age,* v. 156, Aug. 9, '45, p. 61.

Stainless steel cut by oxy-acetylene torch as result of development of a flux-injection process.

22-425. **Welding Electrode Standards.** J. F. Lincoln. *Machine Tool Blue Book,* v. 41, Aug. '45, pp. 187-188.

Cites need for simple, easily understandable standards which would enable a manufacturer to manufacture to such standards consistently, and would enable purchaser to test readily and easily electrodes if he wished to do so, to see if manufacturer was conforming to standards.

22-426. **Welding as an Aid in the Fabrication of Ordnance Material.** Scott B. Ritchie. *Welding Journal,* v. 24, July '45, pp. 629-634.

In development and manufacturing arms and equipment, welding has played a major role. It is one of the fundamental processes. Exhaustive research has been conducted and rapid commercial development has been accomplished within a comparatively short period.

22-427. **Design and Febrication of an All-Welded Pressure Scalder.** W. J. Conley. *Welding Journal,* v. 24, July '45, pp. 635-638.

Illustrates the versatile and practical use of arc welding for economical fabrication.

22-428. **Safety Control for Arc Welders Eliminates Shock.** Herbert Mahumed. *Welding Journal,* v. 24, July '45, pp. 638-639.

With the introduction of a.c. transformer welders in its shops, the safety angle thoroughly investigated.

22-429. **Welding Structures of Hastelloy Alloys.** J. A. Gallagher. *Welding Journal,* v. 24, July '45, pp. 641-650.

Resistant to many chemicals; variety of forms available; fabricated by welding; use of atomic hydrogen arc; metallic arc process; oxy-acetylene welding; liners first plug welded; strip welding developed; test procedures point way to improved techniques; anneals maintain corrosion resistance.

22-430. **The Restriction of E6012 Electrodes.** Omer Blodgett. *Welding Journal,* v. 24, July '45, pp. 651-657.

E6012 electrode has certain advantages which put it in a class by itself. Because of its particular type of coating it has a high deposition rate, and it is ideal for poor fit-up joints in that it does not undercut easily. It can handle high currents without excessive spatter. This electrode produces a convex weld thus insuring a full size weld. It is also ideal for multipass fillet welds in that the passes do not run down as do the so-called hot rods, but rather hold their shape.

22-431. **Templet Tips.** Rudolph Chelborg. *Welding Journal,* v. 24, July '45, pp. 657-659.

Tips, suggested by operators who have used the ideas in making and using templets for oxy-acetylene machine cutting of shapes involving sharp corners or other peculiarities. These ideas should suggest solutions for similar problems faced by other operators.

22-432. **Investigation of the Final Rinsing Operation in the Chemical Surface Preparation of Alclad 24S-T for Spot Welding.** R. A. Wyant, D. J. Ashcraft and T. B. Cameron. *Welding Journal,* v. 24, July '45, pp. 361s-369s.

Series of experiments to determine the effects of time, temperature and composition of water in rinsing Alclad 24S-T sheet following its surface preparation for spot welding. Results show that a reaction sometimes occurs between the surface of the metal and the final rinse water. Effect of the reaction is to raise the contact resistance of the sheet. 6 ref.

22-433. **Fabrication of Large Electrical Machines.** Peter Conway. *Steel Processing,* v. 31, July '45, pp. 427-429.

Specifications for the steel stock depend on the end product and the operations required during fabrication. It presents a problem in welding which can be solved only by use of a very ductile welding rod or by welding the parts while hot.

22-434. **Automatic Welding Aids Construction of Pressure Vessels.** *Steel Processing,* v. 31, July '45, pp. 455-456.

Automatic arc welding employed for joining metals exemplified in the construction of huge tanks for pressure and storage purposes.

22-435. **Furnace Brazing With Aluminum Brazing Sheet.** *Industrial Heating,* v. 12, July '45, pp. 1140, 1142, 1144, 1146, 1148, 1158.

Consists of an aluminum alloy core with a brazing alloy coating, on one or both sides, metallurgically bonded to the core. When heated above the melting point of the coating alloy and below the melting point of the core, in the presence of an appropriate flux, a portion of the coating will melt and flow into the nearest capillary spaces.

22-436. **The Relation Between the Hydrogen Content of Weld Metal and Its Oxygen Content.** L. Reeve. Iron & Steel Institute, Advance Copy, June '45, 12 pp.

Study of the welding of high tensile steel indicates that cracking may occur in the hardened zones of the base plate immediately adjacent to the weld. Determines the relationship between the FeO content of weld metal and its total and diffusible hydrogen content. Total hydrogen content is slightly reduced, while the diffusible hydrogen content is considerably reduced, when the FeO content in the weld is increased. 18 ref.

22-437. **Application of Quality Control to Resistance Welding.** L. S. Hobson, R. S. Inglis and R. P. McCants. *Electrical Engineering,* v. 64, Aug. '45, pp. 573-575.

System of quality control of resistance welding. Standard samples of material identical with production parts are periodically inserted in the welding machine and welded without disturbing the settings and then tested to destruction in a torsion device. The diameter, torque, and angle of twist at failure all are measured and combined into a single number indicative of weld quality. This number is plotted on control charts, and corrective action is taken whenever the control limits are exceeded. By setting these limits well within allowable values the quality of production parts is assured.

22-438. **Designing of "Trouble-Free" Dies, Part I.** C. W. Hinman. *Modern Industrial Press,* v. 7, July '45, pp. 22, 40.

Recent improvements in modern welding equipment. Portable motorized battery cart with a welding gun installation. A welding shop on wheels; scissors types of spot-welding guns; utility spot-welding.

22-439. **Welded 18-8 Steel.** Wilson G. Hubbell. *Iron & Steel*, v. 18, July '45, pp. 230-234.

Effect of stabilizing and stress relief heat treatment.

22-440. **Flash-Butt Welded Joints, Their Design and Properties—Part I.** J. J. Riley. *Product Engineering*, v. 16, Aug. '45, pp. 511-514.

Basic principles in designing flash-butt welded joints discussed and illustrated as they apply both to parts in which design stresses are critical and for which optimum welding procedures have been developed, and to parts in which deviation from standard practice is possible.

22-441. **Strength of Brazed Joints as Affected by Fit and Finish.** W. H. Jones and B. W. Buist. *Product Engineering*, v. 16, Aug. '45, pp. 530-531.

Strength of furnace brazed joints and flow of copper in the joints are shown to be affected by surface finish and fit of the joint, which should be specified in design of parts to be joined by copper brazing.

22-442. **Do You Send Your Equipment to the Cleaner Regularly?** *Industry & Welding*, v. 18, Aug. '45, pp. 38-39, 88-89.

Use of filters wherever possible: set up a system to keep your welding equipment working at its highest efficiency.

22-443. **Oxy-Acetylene Welding Architectural Exteriors for Enamel Finishing.** *Industry & Welding*, v. 18, Aug. '45, pp. 58-59.

Competing against glass, tile and bright metal combinations, welded light gage metal can be shaped and enameled at lower cost. Offers startling and attractive effects. Elaborate equipment for welding not necessary.

22-444. **Operation Pluto.** J. M. Sinclair. *Welding*, v. 13, July '45, pp. 236-241.

Construction of the Hamel pipeline, used in "Pluto," is one of the outstanding British engineering feats of the war. 198,000 flash-butt welds were made in a total length of pipe of 970 miles. Welding program of 12 miles a day was maintained until the work was completed.

22-445. **Welded Machinery Parts.** Edward J. Charlton. *Welding*, v. 13, July '45, pp. 253-262.

Latest developments in the welded design of machine components and gives many examples to prove the advantages of the latest methods of fabrication.

22-446. **Binding Agents for Flux Coatings.** W. Andrews. *Welding*, v. 13, July '45, pp. 263-268.

Recent developments in the application of alternative inorganic binding agents for the flux coatings of metallic arc electrodes and welding rods. Alkaline silicates; drying of silicates; effect of moisture in electrode fluxes; welding of aluminum; use of sodium aluminates; fluorides; mixing operation; mixing equipment; control of water addition; exclusion of reactive flux constituents.

22-447. **New Oil-Field Engine.** *Welding,* v. 13, July '45, pp. 269-270.

Benefits made possible through change-over to welded design. All-welded petrol engine for oil field service which replaced the previous type engine of heavy cast iron construction.

22-448. **Welding Supercharger Turbine Wheels.** G. W. Birdsall. *Steel,* v. 117, Aug. 13, '45, pp. 104-106, 142, 144, 146, 148, 151.

Submerged arc welding, well known for its wide use in fabrication of welded steel ships, exhibits its versatility by meeting the extremely rigid specifications involved in joining cast Vitallium turbine buckets to a stainless steel disk to form the turbine wheel for aircraft turbosuperchargers.

22-449. **Method Is Developed for Flame Cutting Stainless Steel.** *Steel,* v. 117, Aug. 13, '45, pp. 107, 152.

Unit consists of a cylindrical container from which the flux is fed into the lines in predetermined amounts by a motor-driven screw feed mechanism. Container has a capacity of 35 lb. of flux. Modified hand torch was built to provide necessary flux control.

22-450. **Heliarc Welding at Northrop.** F. Masdeo. *Welding Engineer,* v. 30, Aug. '45, pp. 35-39.

Successful arc welding of magnesium alloys makes it possible to revolutionize aircraft design. Full details of this development after several years' trial.

22-451. **Welding in a Cement Mill.** T. B. Jefferson. *Welding Engineer,* v. 30, Aug. '45, pp. 44-46.

Welding arcs and sparks are a familiar sight around a cement mill. Long ago the cement mill operator learned of the 100 important uses to which welding may be put.

22-452. **Semi-Automatic Welding.** John Lippart. *Welding Engineer,* v. 30, Aug. '45, p. 47.

Ingenuity in the design of special handling facilities made it possible to use automatic welding machines on large parts of irregular shapes.

22-453. **Fabricating Locomotive Parts.** *Welding Engineer,* v. 30, Aug. '45, pp. 48-50, 77.

Welded locomotives, trucks and platforms have proved themselves to be strong without excess weight. They are easily fabricated by cutting and welding readily available rolled steel plates and structural shapes.

22-454. **Welded Safety Guards.** *Welding Engineer,* v. 30, Aug. '45, p. 50.

To test the electrical connections of bomber turrets, it was necessary to devise a "third-rail" power supply. Welding made possible an ingenious, flexible system.

22-455. **Welding Heavy Armor Decks.** J. S. Wright. *Welding Engineer,* v. 30, Aug. '45, p. 52.

Warpage proved a tough problem in the butt welding of 1½-in. deck plates on warships. It was finally overcome by using jack-clamps before welding.

22-456. **Spot Welding Aids Maintenance.** Lee Brady. *Welding Engineer,* v. 30, Aug. '45, p. 54.
Example in the use of spot welding by small shops for purely maintenance purposes.

22-457. **Maintenance on the Home Front.** *Welding Engineer,* v. 30, Aug. '45, p. 60.
Boilers, oil tanks and tar kettles are some of the necessities for the home front which a St. Louis jobber is keeping in service by welding.

22-458. **Flash Welding Alloy Steel Rings.** P. B. Scharf. *Iron Age,* v. 156, Aug. 16, '45, pp. 50-53.
Flash welding methods used satisfactorily in the production of mild steel rings applied to alloy steel.

22-459. **Brazing of Heat Treated Parts.** *Iron Age,* v. 156, Aug. 16, '45, pp. 54-55.
Shear test on integral component shows that silver brazing is a satisfactory method for joining heat treated parts and meets definite tensile strength requirements.

22-460. **Determining Surface Resistance of Aluminum for Welding.** *Iron Age,* v. 156, Aug. 16, '45, p. 74.
Kelvin double-bridge device improves control over the cleaning and deoxidation of the aluminum stock.

22-461. **Oxy-Acetylene Machines Meet Varied Cutting Requirements.** G. V. Slottman. *American Machinist,* v. 89, Aug. 16, '45, pp. 106-110.
Different machines and auxiliary equipment reviewed.

22-462. **Automatic Welding Applied to Large and Small Lots.** *American Machinist,* v. 89, Aug. 16, '45, pp. 122-123.
Experience of two manufacturers proves the process versatile if positioners and fixtures are designed for maximum flexibility.

22-463. **Progress in Heliarc Welding.** T. E. Piper. *Automotive Industries,* v. 93, Aug. 15, '45, pp. 27-28, 78.
Short history of the process.

22-464. **One-Station Variable Speed Control Adds Flexibility to Automatic Welding,** *Steel,* v. 117, Aug. 27, '45, pp. 103, 148, 150, 152, 154.
In automatic welding two elements control the speed of production: Welding time and handling time. Handling time as the principal factor for consideration discussed.

22-465. **A Symposium on Special Shapes for Welding.** D. B. Wilkin. *Steel,* v. 117, Aug. 27, '45, pp. 104-107, 150, 152, 154.
Steel fabricators describe types of sections which would facilitate production of finished products. Half of over 1900 plants want more special shapes.

22-466. **Resistance Welding Fundamentals.** F. R. Woodward. *Welding Journal,* v. 24, Aug. '45, pp. 713-725.
Product design considerations; spot welding; seam welding; projection welding; butt welding; flash welding; materials to be welded; welding of dissimilar materials.

22-467. **Shop Notes on Welding Stainless Steel.** Vincent J. Shanahan. *Welding Journal,* v. 24, Aug. '45, pp. 727-729.

Comparison of welding carbon steel and stainless steel; effects of heat on stainless steels; selection of the type of electrodes; selection of sizes and quantity of electrodes; operating instructions; oxy-acetylene welding.

22-468. **Research—an Irresistible Force.** Howard E. Fritz. *Welding Journal,* v. 24, Aug. '45, pp. 741-745.

Welding research is of recent growth, but, as with all other processes and products, it is necessary for progress. Refusal to experiment, or to change as a result of the information available from experiment, leads to stagnation and decay.

22-469. **A Welded Swing Bridge Made of Low Alloy Steel.** M. Baudelaire. *Welding Journal,* v. 24, Aug. '45, pp. 401s-403s.

Description of the bridge; description of the members; the nature of joints; base metal; weld metal; welding procedures; inspection of welds.

22-470. **An Investigation of the Spot Welding of Aluminum Alloys Using Condenser-Discharge Equipment.** W. F. Hess, R. A. Wyant and B. L. Averbach. *Welding Journal,* v. 24, Aug. '45, pp. 404s-412s.

Comparative study of three different types of welding equipment which are offered for the spot welding of aluminum alloys for aircraft structures. Equipment; procedure and results.

22-471. **Production Technique and Quality of Flash-Welded Joints.** Hans Kilger. *Welding Journal,* v. 24, Aug. '45, pp. 413s-432s.

Methods and equipment; welding procedure and terminology; welding schedules and machine limitations; preheating and flashing; heating the work—influence of welding on structure and heat-effect zone; tensile strength and hardness. (Translation of Fertigungstechnik und Güte Abbrenngeschweisster Verbindungen.)

22-472. **Resistance Welding, Part I.** R. W. Ayers. *Aircraft Production,* v. 7, Aug. '45, pp. 379-384.

Modern developments and applications in up-to-date fabrication methods.

22-473. **Cutting of Stainless Steels by Torch Made Possible by New Equipment.** *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 981, 983.

Quality production cutting of stainless steels solved through development of the Airco flux-injection system. Description.

22-474. **Spot Welding Aluminum.** F. Roper-Lowe. *Metal Industry,* v. 67, Aug. 17, '45, p. 104.

Novel method using low current density.

22-475. **Welding Fluxes for Magnesium.** *Light Metals,* v. 8, Aug. '45, pp. 380-381.

Recently patented flux compositions designed to overcome special difficulties encountered in welding certain of the newer ultra-light alloys.

22-476. **Steel Welding Costs and Electrode Selection.** Orville T. Barnett. *Metals & Alloys,* v. 22, Aug. '45, pp. 408-414.

How to select mild steel arc welding electrodes to satisfy quality requirements while achieving the lowest possible over-all operating cost. 8 ref.

22-477. **Skin Heating.** *Iron Age,* v. 156, Sept. 6, '45, pp. 86-87.
Improved surface finish is being obtained in aircraft by thermal expansion of the light-alloy skin prior to riveting. Practice suggests possibilities for fabrication of certain peacetime goods.

22-478. **Automatic Control Speeds Production Welding.** *Production & Engineering Bulletin,* v. 4, June '45, pp. 114, 116, 119.
Long or short production runs can be set up with equal ease as a result of the new welding tools and controls now available. Handling time again has become the principal factor for consideration.

22-479. **Man-Hours Saved During Welding.** *Production & Engineering Bulletin,* v. 4, June '45, p. 203.
How waste heat generated during welding was used for preheating the work to save labor and fuel.

22-480. **Speeding Work in a Welding Shop.** *Production & Engineering Bulletin,* v. 4, June '45, pp. 213-215.
How a well-designed shop layout helped the flow of work, from the entrance of parts to the exit of a welded and painted product.

22-481. **Welding Technique in Construction of Fairchild "Packet".** James A. Wales, Jr. *Steel Processing,* v. 31, Aug. '45, pp. 496-498.
Biggest welding job in connection with production is found on the cargo plane's landing gear. Details given.

22-482. **New Developments in Aluminum Brazing.** Mike A. Miller. *Metal Progress,* v. 48, Sept. '45, pp. 477-483.
Discussion limited to some of the newer developments; illustrates a few of the current applications. Emphasis placed mainly on torch, furnace and flux bath procedures. A few of the special techniques developed during the past few years also considered.

22-483. **A Preliminary Investigation of the Constitution of Mild Steel Arc Weld Deposits.** H. A. Sloman, T. E. Rooney and T. H. Schofield. Iron & Steel Institute, Advance Copy, July '45, 29 pp.
Oxygen, hydrogen and nitrogen contents of mild steel weld deposits laid down under certain standard conditions, and also the form in which the oxygen is present, have been determined. Deposits from six different electrodes were found to differ appreciably in their contents of the gaseous elements. Observations connecting these differences with the compositions of the electrode coatings have been made. 4 ref.

22-484. **Welding as an Important Tool in Aluminum Fabrication.** W. J. Conley. *Aluminum & Magnesium,* v. 1, Aug. '45, pp. 28-31.
Process shows consistently lower costs and higher rates of production than any previously known methods of fabrication.

22-485. **New Automatic Riveting Machine.** *Aero Digest,* v. 50, Sept. 1, '45, pp. 120-121.

Drivmatic automatic riveting machine drills and countersinks the rivet hole. Combined metal thickness may become as great as ⅜ in. Machine gages the combined metal thickness, drills and countersinks the hole, then selects, inserts, and heads one of five lengths of rivets of the same head style and body diameter.

22-486. **Tapping Screws.** Walter M. Hanneman. *Fasteners,* v. 2, no. 3, pp. 4-7.

Offer an economical medium for certain types of fastening.

22-487. **Cold Riveting Gains Acceptance.** *Fasteners,* v. 2, no. 3, pp. 16-17.

With properly controlled pressures, cold driving of large rivets offers a number of advantages. Holes are completely filled, caulking against leaks is unnecessary, rivets attain superior physical characteristics, and the cost is reduced by elimination of heating and easier handling of cold rivets.

22-488. **Multiple Brazing.** G. W. Birdsall. *Steel,* v. 117, Sept. 10, '45, pp. 108-111, 156, 158, 160, 162, 164, 166.

Makes five brazed joints simultaneously in typical small pressure vessel used as insecticide container. Millions of units processed by copper brazing in controlled atmosphere furnaces show process to be extremely effective low-cost mass production method of joining steel parts.

22-489. **Pointers on Preparing Workpieces for Flame-Cutting Operations.** G. V. Slottman. *American Machinist,* v. 89, Sept. 13, '45, pp. 106-109.

Mounting techniques, essential fixtures and methods for the correction of cuts in progress are discussed.

22-490. **Flash Welding of Sheet Brass.** T. Watson and A. J. Hipperson. *Iron Age,* v. 156, Sept. 13, '45, pp. 55-59.

In adapting flash-butt welding methods to non-ferrous metals, difficulties have been encountered by the manufacturers of small parts. Details of a recently established method which has been found efficient for flash-butt welding thin sections of brass. (From British journal *Welding.*)

22-491. **Edge Preparation of Ship Plate.** Cyril Provo Hubert. *Iron Age,* v. 156, Sept. 13, '45, pp. 60-63, 148.

Utilization of mechanical cams in conjunction with a flame-planer permits trim edging of plate edges to any desired contour and combination of bevels within limits of $\pm$ 0.003 in. High quality welds result, and twice the production rate is obtained than by use of hand-operated cutting equipment.

22-492. **"Whale" Piers for "Mulberry".** A. Lamond and R. G. Braithwaite. *Welding,* v. 13, Aug. '45, pp. 287-294.

"Whale" piers played a vitally important part inside the famous Mulberry Harbors; describes the fabrication and production of the floating bridges for the "Whale" project. Work described involved the fabrication of 9500 tons of steel and 350 miles of welding within a period of nine months.

22-493. **Manual Welding Manipulators.** F. W. Sykes. *Welding,* v. 13, Aug. '45, pp. 295-302.
Construction and application.

22-494. **Welded Machinery Parts.** Edward J. Charlton. *Welding,* v. 13, Aug. '45, pp. 303-306.
Various developments in the welded design of machine components with many examples to prove the advantages of the latest methods of fabrication.

22-495. **Binding Agents for Flux Coatings.** W. Andrews. *Welding,* v. 13, Aug. '45, pp. 307-312.
Recent developments in the application of alternative inorganic binding agents for the flux coatings of metallic arc electrodes and welding rods. 14 ref.

22-496. **Repairs in the Gas Industry.** J. K. Johannesen. *Welding,* v. 13, Aug. '45, pp. 313-315, 318.
Examples of maintenance work.

22-497. **New Electrode Plant.** *Welding,* v. 13, Aug. '45, pp. 316-318.
Capacity of 350 coated rods per minute; new design of die head; heat treatment.

22-498. **Welding in Palestine.** P. Lidor. *Welding,* v. 13, Aug. '45, pp. 319-320.
Stainless steel equipment for food production.

22-499. **Line Drop Produced by Resistance Welders.** R. L. Longini. *Electrical Engineering,* v. 64, Sept. '45, pp. 619T-622T.
Resistance welding machines normally form a very reactive pulsating load on a power system which sometimes produces undesirable line regulation. The regulation can be calculated, and, if it is too high, it can be reduced by operation directly on 2300 volts or by power factor correction means. From a line regulation point of view, the system of 2300-volt operation is usually the most satisfactory. The effect of electronic controls on line drop is also discussed.

22-500. **When the Welding Load Outgrows the Distribution Power Supply.** C. N. Clark and C. M. Stearns. *Electrical Engineering,* v. 64, Sept. '45, pp. 645T-647T.
Ability of a 2300 to 4000-volt distribution system to supply single-phase a. c. welders is limited not only by current-carrying capacity, but also by voltage regulation. The voltage limitations are reviewed and methods suggested for increasing the limits by changes in the power system and the customers' installations. Three types of subtransmission connections are described for use when the welding load outgrows the distribution power supply.

22-501. **Thermal and Metallurgical Aspects of the Welding of Hot-Dip Galvanized Steel.** E. F. Pellowe and F. F. Pollak. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1423-1426.
Mechanical pressure; general technical comments.

22-502. **The Welding of Non-Ferrous Metals. Part VI.** E. G. West. *Sheet Metal Industries,* v. 22, Aug. '45, pp. 1427-1433, 1438.
Fundamentals involved; resistance welding plant.

22-503. **Industrial Electrodes, IV.** H. Sanders. *British Steelmaker,* v. 11, Sept. '45, pp. 409-412.

Some notes on best means of preventing avoidable wastage in electrode consumption.

22-504. **Overseas Workshop Welding Instructions.** M. H. Vuchnich. *Industry & Welding,* v. 18, Sept. '45, pp. 40-41, 94-99.

General rules for welding procedure. Clear, concise descriptions and limitations will be of value to the man in rural areas and to many newcomers.

22-505. **Ingenuity Speeds Transmitter Tube Brazing.** *Industry & Welding,* v. 18, Sept. '45, pp. 42-43, 86-89.

Where brazing of small parts must be perfect this technique should be of real interest.

22-506. **Automatic Arc Welding Speeds Marine Equipment.** *Industry & Welding,* v. 18, Sept. '45, pp. 49, 51.

Submerged arc welding installation. Typical of many for heavy duty fabrication jobs calling for high quality welds to meet the rigid specifications of the American Bureau of Shipping.

22-507. **Welding Band and Circular Saw.** Lee Brady. *Industry & Welding,* v. 18, Sept. '45, pp. 76-77, 79-81.

Used for emergency, as well as for permanent repairs, and is proving both inexpensive and serviceable.

22-508. **Flash Butt-Welding Heavy Sections.** Irwin H. Such. *Steel,* v. 117, Sept. 17, '45, pp. 116-118, 150, 152, 154.

Huge 1200-kva. machine designed to join shafts to jet engine turbine wheels in 135 sec. can handle shafts ranging from 1 to 6 in. in diameter, 12 to 72 in. in length and wheels from 5 to 40 in. in diameter.

22-509. **Radio Heating and Mass Production Soldering.** Christopher E. Tibbs. *Electronic Engineering,* v. 17, Aug. '45, pp. 631-633.

Reviews possibilities which have been opened up by this technique.

22-510. **Welded Reduction-Gear Cases.** C. E. Sommarstrom and Fred M. Burt. *Welding Engineer,* v. 30, Sept. '45, pp. 39-41.

30-ton welded housings for 8500-hp. marine reduction gears. Welding positioners of 1½, 7 and 20 tons help to turn out a complete case a week with a crew of only eight fitters and welders.

22-511. **Arc Welding Pure Aluminum.** F. H. Keating. *Welding Engineer,* v. 30, Sept. '45, pp. 42-43.

British chemical industry needed vessels of high-purity aluminum to withstand corrosion. Metallurgists overcame the welding difficulties by switching to the metal-arc process—and a new type aluminum electrode.

22-512. **New Control for Automatic Welding.** *Welding Engineer,* v. 30, Sept. '45, pp. 44-45.

Application of a variable-speed drive turns the welding positioner into a brand-new tool for automatic welding. Any table speed from 0.3 to 3 rpm. can be obtained, and welding and table rotation are started simultaneously.

22-513. **Better Jobs From Flame-Cutting.** A. F. Chouinard. *Welding Engineer,* v. 30, Sept. '45, pp. 46-49.

How to get the most out of shape-cutting machines. Types of machines and tracing devices, when to build a template, nesting methods, template storage and work tables are some of the topics discussed.

22-514. **Brazing Replaces Soldering.** W. Scott. *Welding Engineer,* v. 30, Sept. '45, pp. 50-53.

Need for wartime conservation of tin has led to an ever increasing use of brazing or hard soldering for various metal-joining tasks. Extra advantages such as strength and electrical conductivity are often found.

22-515. **Spot Welding Locomotive Cabs.** W. H. Cochran. *Welding Engineer,* v. 30, Sept. '45, pp. 54-56.

Diesel-electric locomotive cabs are being made by spot welding light-metal sheets to formed stiffeners. Spot welding is also used for engine cabs and other parts.

22-516. **Welded Bearings for Frigates.** G. G. Landis. *Welding Engineer,* v. 30, Sept. '45, p. 57.

Advantages of fabricating bearings by welding are strikingly demonstrated in the design of big bearings for Frigate escort vessels of the Maritime Commission.

22-517. **Removal and Repair of Steel Casting Defects.** R. A. Pomfret. *American Foundryman,* v. 8, Sept. '45, pp. 48-53.

Flame-gouging and welding as means of removal and repair of structurally unsound areas in critical castings have reduced casting repair costs. The more searching inspection methods now in general use have shown that repair welding can be eliminated to a great extent by provision for sub-sectioning and weld location in the casting design. Flame gouging-welding techniques for casting repair, as well as precautions to be observed, are described in detail.

22-518. **Silver Brazing of Steel Parts.** A. M. Setapen. *Steel,* v. 117, Sept. 24, '45, pp. 112-115.

Expanded rapidly under stimulus of war demands. Advantages include high strength, gas tightness, fast production, low cost.

22-519. **Power for Welding.** L. W. Clark. *Welding Journal,* v. 24, Sept. '45, pp. 811-817.

Discussion of power supply for resistance welders. Lamp flicker; early welder trouble; welder operation; utility system; stepdown transformer banks; low-voltage bus and feeders; good and poor installations; welding machines and their operation.

22-520. **A Machine for Production Flame Cutting of Small Shapes.** E. E. Hart. *Welding Journal,* v. 24, Sept. '45, pp. 819-823.

Eight-torch flame-cutting machine in which all operations, after the multi-component bars are placed on the machine, are mechanically carried out. Discussion limited to shapes up to 3x7x24 in.

22-521. **Arc Welding Engineering Problems and Engineers.** Walter J. Brooking. *Welding Journal,* v. 24, Sept. '45, pp. 825-832.

Evaluating and selecting welding processes, machines and equipment; evaluating and selecting welding electrodes; evaluating and testing welding operators; adapting welding operators by training; correlating design with practical shop practice and equipment; create fixtures for setting up and positioning for welding; establish procedures for welding the company's products; organize detail welding control; establish quality control (inspection); keeping abreast of practice within the industry; who then is a welding engineer.

22-522. **Resistance Welding Laboratories and Their Instruments.** R. T. Gillette. *Welding Journal,* v. 24, Sept. '45, pp. 833-837.

Briefly outlines functions of welding, laboratory and equipment.

22-523. **Machine Gas Cutting.** R. M. Dennis. *Welding Journal,* v. 24, Sept. '45, pp. 839-842.

Discussion of some of the innovations and accessories that have been devised and developed for use in the flame cutting department of By-Products Steel Corp.

22-524. **Metallurgical Factors of Underbead Cracking.** S. L. Hoyt, C. E. Sims and H. M. Banta. *Welding Journal,* v. 24, Sept. '45, pp. 433s-445s.

Relative underbead cracking tendencies of hardenable steels, such as S.A.E. 4130, may be determined by a simple weld test made under carefully controlled conditions. Extent of underbead cracking, crack sensitivity, can be correlated with the dilatometric characteristics obtained in a rapid thermal cycle. Restraint and thermal stresses in a weld are not primary causes of underbead cracks but are responsible for their propagation. 4 ref.

22-525. **Production Technique and Quality of Flash Welded Joints.** Hans Kilger. *Welding Journal,* v. 24, Sept. '45, pp. 459s-480s.

Tensile strength and hardness; defective welds.

22-526. **The Welded Tank.** *Welding,* v. 13, Sept. '45, pp. 336-343.

British armored fighting vehicles are now welded. Case for the welded tank; investigational work; welding of heavy armor; battleworthiness and joint design; jigs and manipulators.

22-527. **Hot Riveting.** R. Bushell. *Welding,* v. 13, Sept. '45, pp. 344-347.

Electrical upsetting process.

22-528. **Flash-Butt Weld Quality.** W. Forbes Young. *Welding,* v. 13, Sept. '45, pp. 348-351.

Suggestions regarding maintenance of standard. Check of units to be welded; clamping dies; travel of the moving head; fully automatic machine; possible causes of faulty welding.

22-529. **Under Water Cutting.** Edward T. Forey. *Welding,* v. 13, Sept. '45, pp. 355-359.
Applications of the oxy-hydrogen process. Regulation of gas pressures; alterations to bridges; Tripoli harbor operations.

22-530. **Industrial Application of Automatic Submerged Arc Welding.** R. R. Sillifant. *Welding,* v. 13, Sept. '45, pp. 360-370.
Development of the Unionmelt process. Details of types and scope of the process, indicating future possibilities. (South Wales Institute of Engineers.)

22-531. **Spot and Seam Welding Aluminum.** O. A. Perry. *Light Metal Age,* v. 3, Sept. '45, pp. 10-13.
Discusses the rapid development of spot welding alloys, and current equipment and practices. Peculiar difficulties inherent in this process and methods of overcoming them are considered, and pertinent data given. Advantages of spot welding aluminum summarized.

22-532. **Welding on Mexican Railways.** J. W. Boyd. *Railway Mechanical Engineer,* v. 119, Oct. '45, pp. 435-436.
Material shortages overcome by the extensive use of welding repair and reclamation. Lack of any limiting regulations allowed wide range of applications. Mexicans are skillful operators and the results have been good.

22-533. **Redesign for Welding—Gas Turbine Plant.** J. F. Cunningham. *Industry & Welding,* v. 18, Oct. '45, pp. 38-41, 70.
Extended use of welding in the construction of a gas turbine plant brings up some interesting problems in connection with welding on materials fit for high temperature work.

22-534. **Metal Bonding.** *Automobile Engineer,* v. 35, Sept. '45, pp. 354-356.
Redux process. Strength of the joint is sufficient, even at the high temperatures occasionally developed. Applications; design considerations; processing procedure.

22-535. **Unusual Results With Automatic Soldering.** W. R. Graham. *Machinery,* v. 52, Oct. '45, pp. 158-161.
Eliminating hand work and the need of skill in soldering increased production nearly 450% in one case, and also improved the product.

22-536. **Improved Method of Brazing Carbide Tips to Shanks.** *Machinery,* v. 52, Oct. '45, pp. 192-193.
By using the specially brazed tools, production has increased 42%. Able to obtain from three to ten grinds per tool with increased production per grind.

22-537. **Stainless Steel Welds Improved by Helium Shielded Arc.** W. H. Jones. *Product Engineering,* v. 16, Oct. '45, pp. 708-709.
Advantages of helium shielded arc welding for stainless steel in thin sheets or sections, on which adoption of this method by industry is based. Design of joints outlined.

22-538. **Induction Brazing Becomes a Fabricating Medium.** H. A. Walker. *Production Engineering & Management,* v. 16, Oct. '45, pp. 72-74.

As a result of the application of induction heating techniques, brazing has developed into an important fabricating medium useful in large or small production operations

22-539. **Some Applications of Atomic Hydrogen Arc Welding.** A. E. Near. *Steel Processing*, v. 31, Sept. '45, pp. 555-559, 585

Scope of application of atomic hydrogen arc welding processes will inevitably broaden. Describes some specific applications; outlines the basic principles of the process Cast and wrought aluminum and its alloys; electronic tube fabrication; die repair and fabrication; chain links for crane slings; alloys for high temperature operation

22-540. **Effect of Recent Research on the Weldability and Control of the Production of Steel Aircraft Tubing.** Arthur J. Williamson. *Aeronautical Engineering Review*, v. 4, Sept. '45, pp. 5, 7, 9, 11, 13, 17, 19-21, 23.

Standard sample—cracking measurements; dilatometer studies; statistical data; metallographic studies; effect of aluminum on steel-making practice; aluminum versus cracking effect of sulphur; cracking of NE steels; postheating; hardness versus cracking; additional data; steel aircraft tubing.

22-541. **Five Years of Progress in Welding.** W. Spraragen *Metal Progress*, v. 48, Oct. '45, pp. 905-916.

Weldability problem; weld stress problem; graphitization of steam lines; weldability of specific steels; some arc welding advances; resistance welding; solid phase welding; gas cutting; a look ahead.

22-542. **Mechanical Oxy-Acetylene Welding.** H. O. Jones *Steel*, v. 117, Oct 8, '45, pp. 104-106, 146, 148, 152, 154.

Non-continuous setup in plant of Artcrest Mfg. Co. provides economies in fabricating cylindrical steel containers

22-543. **Methods for Controlling Plate Motion During Flame-Cutting Operations.** G. V. Slottman. *American Machinist* v. 89, Oct. 11, '45, pp. 114-117.

Skip-cutting, use of taper pins, and clamping procedures for the control of thermal expansion.

22-544. **Precision Cutting of Steel Requires Separate Control.** G. V. Slottman. *American Machinist*, v. 89, Sept. 27, '45, pp. 114-116.

An accurate knowledge of kerf widths, thermal expansion and plate motion are important in precision operations.

22-545. **Recorded Tests Prove Effective in Maintaining Welding Quality.** John Holden. *American Machinist*, v. 89, Sept 27, '45, pp. 126-128.

Establishment of a quality control program in the welding department relieves the supervisor of keeping a close watch on all operational details and he is in a position to rectify jobs showing poor welds. Two simple forms used

22-546. **Rubber Inserts Cut Riveting Troubles.** Alex Carlson. *American Machinist*, v. 89, Sept. 27, '45, pp. 129-130

Shop tests reveal that shock transmitted to the bodies of rivet-gun operators and helpers is reduced sharply by simple changes in guns and bucking bars.

22-547. **Resistance Welding. Part II.** R. W. Ayers. *Aircraft Production,* v. 7, Sept. '45, pp. 446-450.
Equipment for spot welding light alloy material; stitch and projection welding.

22-548. **Welded Construction Reduces Die Cost.** John Mikulak. *Iron Age,* v. 156, Oct. 4, '45, pp. 83-84.
Substitution of welded dies yields excellent results by reducing first cost and increasing die life.

22-549. **Redesign for Welding Non-Ferrous Bellows.** *Industry & Welding,* v. 18, Oct. '45, pp. 46, 48.
Cook Electric Co. manufactures a variety of bellows. Because of the wide range of sensitivity of various metals they have been adapted to solve numerous engineering problems.

22-550. **Shop Notes on Welding Stainless Steel.** Vincent J. Shanahan. *Industry & Welding,* v. 18, Oct. '45, pp. 57, 72-74, 76-78, 80.
No reason for welding operators to hesitate when it comes to welding stainless steel. 18-8 stainless types can be, and are, readily welded by the metallic arc and the acetylene process.

22-551. **Redesign for Flash Welding Alloy Steel Rings.** P. B. Scharf. *Industry & Welding,* v. 18, Oct. '45, pp. 58-62, 64.
Rings, of mild steel, have been produced by flash welding. Process developed to a high production, low cost ring manufacturing method. Products produced, and the techniques employed described.

22-552. **Redesign for Induction Brazing Small Parts.** Charles T. Pearson. *Industry & Welding,* v. 18, Oct. '45, pp. 84-89.
Brazing, at one time associated with minor emergency repair jobs, has become a more important medium for fabrication of metal parts with the increased use of induction heating and brazing alloys.

22-553. **The Weld Stress Problem.** *Canadian Metals & Metallurgical Industries,* v. 8, Sept. '45, pp. 30-32, 34-35, 47.
Factors leading to the formation of stresses are briefly reviewed. Assuming a crack-free structure, although containing high residual stresses, the weld stress problem is carefully considered and broken down into its essential elements.

22-554. **Safety Factors in Arc Welding.** R. F. Wyer. *Metals & Alloys,* v. 22, Sept. '45, pp. 742-747.
How the highly overrated electrical shock hazard in the arc welding process may be reduced through simple precautions.

22-555. **Twin-Arc System Improves Welding Efficiency.** M. H. MacKusick. *Iron Age,* v. 156, Sept. 27, '45, pp. 58-59.
Warping and residual stresses in the welded joints for ship plates have been materially reduced by the Twin-Arc welding technique. Various passes are made simultaneously from both sides of the joint, cracking of the root pass is avoided, and back chipping eliminated.

22-556. **Layout of a Welding Shop.** T. Scott Glover. Institute of Welding *Transactions,* v. 8, Aug. '45, pp. 93-99.
The welding shop and plant layout from a general en-

gineering point of view. Outlines a specific example drawing attention to the consideration involved and the reasons for the arrangement as carried out.

22-557. **New Developments in Technique of Deep Penetration Welding.** Barry W. Silverwood. Institute of Welding *Transactions,* v. 8, Aug. '45, pp. 101-108.

Practical applications to unprepared or semi-prepared plate butts. High speed, high current, butt welding in steel plate.

22-558. **Deep Penetration Welding on Plates Over 0.350 In. Thick.** D. M. Kerr. Institute of Welding *Transactions,* v. 8, Aug. '45, pp. 109-111.

Experience of welding applied to ship construction. X-rays of typical welds discussed.

22-559. **Constitution of Weld Metals.** W. Andrews. Institute of Welding *Transactions,* v. 8, Aug. '45, pp. 119-132.

Results of research arising from practical problems. General chemical analysis of the weld metal of representative commercial electrodes; detailed examination of selected weld deposits; examination of metallic arc weld deposits made by anhydrous fluxes; microstructure and constitution; effects and reactions.

22-560. **Some Electrical Characteristics of Spot Welding Machines.** C. L. Railton and A. J. Hipperson. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1609-1617.

Investigations to determine to what extent the secondary current of a spot welder is affected by various conditions of the secondary loop, i.e., by throat depth and throat opening, and by the amount of magnetic material in the throat. Results of the tests reported.

22-561. **The Welding of Non-Ferrous Metals. VI. Resistance Welding Equipment Principles and Control Methods.** E. G. West. *Sheet Metal Industries,* v. 22, Sept. '45, pp. 1618-1622, 1624.

Alternating current machines; control methods for a.c. machines; power supply; condenser-discharge welding machines; induction storage machines; other resistance welding machines. 5 ref.

22-562. **Container Line.** *Steel,* v. 117, Oct. 15, '45, pp. 112-113, 154.

Unusually effective setup that makes 35-in. longitudinal welds at rate of 400 hourly, using submerged arc process.

22-563. **Produces Over 19,000 Miles of Electric Welded Tubing.** *Steel,* v. 117, Oct. 15, '45, pp. 114-115, 144, 146.

Two mills make tubes ¾ to 4 in. diameter at rate of 4000 tons a month. Scale-free skelp is fed into sizing mill where by mechanical control it is brought to the required thickness. Butt welding ends together affords continuous operation of mill. Rigid inspection and testing maintained.

22-564. **Steel Plant Welding.** W. K. Simon. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 92-96.

Examples of welded construction in steel plant equipment which demonstrate many possibilities of economy.

22-565. **Composite Generator Frames.** G. W. Birdsall. *Steel,* v. 117, Oct. 22, '45, pp. 114-118.

Jack & Heintz develops highly effective setups for mass production of cylindrical frames for electric generators for aircraft. Three ring sections are welded into a single piece by automatic submerged arc. Six openings near each end are cut out on automatic multiple torch machine with special indexing fixtures.

22-566. **Manual and Automatic Tracers Require Accurate Templets.** G. V. Slottman. *American Machinist,* v. 89, Oct. 25, '45, pp. 126-130.

Design and application of multiple-type templets are described.

22-567. **Repair of Magnesium Parts by Gas Welding.** *American Machinist,* v. 89, Oct. 25, '45, p. 147.

Generally speaking, such repairs should be considered a temporary measure until a replacement part can be obtained, and deviations from normal practice may be required in order to put the parts back in service quickly. Examples of such deviations are: Use of multiple beads; the welding of sections that are impossible to clean thoroughly; the welding of cast metal.

22-568. **Cutting Under Water.** G. W. Birdsall. *Steel,* v. 117, Oct. 29, '45, pp. 102-103, 136, 138.

Now possible at any depth by simple equipment that cuts steel and other ferrous metals at high speed. Valuable wartime development seen to have important applications in salvage, harbor clearance and certain construction operations. Also advantageous for cutting in air. typical job being done in 66% less time than required by conventional method.

22-569. **Copper Brazing of Incendiary Bombs at Republic Steel Corp. Plant.** *Industrial Heating,* v. 12, Oct. '45, pp. 1722-1724, 1726, 1728, 1730, 1798.

Describes the operations as carried out in the Niles plant, which employed the electric brazing furnace shown.

22-570. **Welded Design Influences Construction of Modern Mine Cars.** Gilbert P. Muir. *Steel Processing,* v. 31, Oct. '45, pp. 630-632.

Welding the truck assembly; fabrication of the body.

22-571. **Some Suggestions for Better Spot Welding.** T. A. Beck. *Steel Processing,* v. 31, Oct. '45, pp. 639-640.

In most cases the rejections can be traced down to the parts themselves. Sometimes it is the steel being dirty or rusty, other times it may be due to the shape of the parts. With good inspection of parts and electrode maintenance, rejections will be cut to a minimum.

22-572. **Applications of Arc Welding in Aircraft Construction.** C. P. Keogh. *Steel Processing,* v. 31, Oct. '45, pp. 641-643.

Essentials for satisfactory welds are: The specified material must be of real welding quality; the minimum thickness of steel should be 17 swg.; acute angles for fillet welds to be avoided unless the material is relatively thick; for outside corner welds one plate should not pro-

ject past the other by more than the thickness of the plate; sufficient room for the fillet must be provided; fit up of the joint must be accurate and close; machining of weld junction can only be carried out if the work is annealed.

22-573. **Brazing Alloy Tool Tips by Induction Heating.** T. A. Vernor and E. F. Adams. *Steel Processing,* v. 31, Oct. '45, pp. 652-653.

Brazes alloy tool tips onto single point tools in a fraction of the time formerly required with acetylene gas torches. When acetylene torches were used, the tool tip was overheated and several minutes were required to braze each piece. Tool tips can now be brazed on a 1½x1½-in. tool, which is the largest used, in about 30 sec. using induction heating.

22-574. **Hidden-Arc Welding of 13-Gage Steel.** H. E. Cable. *Iron Age,* v. 156, Nov. 1, '45, pp. 52-53.

New welding advancement helps speed production in the manufacture of thousands of watertight metal containers for shipping and storing bombs. Procedure outlined.

22-575. **Current Ranges for Quality Welding.** Orville T. Barnett. *Steel,* v. 117, Nov. 5, '45, pp. 124-125, 158, 160, 162, 164.

Closer limits on current and voltage settings for various types of electrodes are providing better welding results.

22-576. **Combustion Ingenuity Speeds Transmitter-Tube Brazing.** *Industrial Gas,* v. 24, Oct. '45, pp. 23-24.

Rejections and time have been saved by ingenious adaptations of gas-air combustion in replacement of conventional oxy-gas techniques at two vital points of manufacture. First, open rings of special ceramic-cell gas burners have been adapted to silver-braze the heavy copper collar on the flared anodes. Second, an unusual gas-fired furnace serves to keep both the finned-radiator-assembly and the anode of the finished tube uniformly at proper temperature for long periods while cadmium or other solder is being puddled and flowed for perfect bonding of the two elements into one assembly.

22-577. **Low-Tin Solders.** *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, p. 1125.

Properties of solders compared.

22-578. **Arc Welding Electrode Classification.** *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, p. 1131.

System for classifying arc welding electrodes prepared by the American Welding Society and the American Society for Testing Materials.

22-579. **Silver Brazing.** J. P. Weed. *Metal Industry,* v. 67, Oct. 5, '45, pp. 217-218.

Use of silver brazing not only increases production but in many cases improves both the appearance and strength of the job while reducing the weight. (Paper presented to the American Welding Society.)

22-580. **Hard-Facing in an Oil Refinery.** G. W. Nigh. *Welding Engineer,* v. 30, Oct. '45, pp. 41-43.

One of the largest savings in oil refinery maintenance

is that made possible by applying hard-facing to areas where the metal surfaces are in sliding contact. Examples show how costly shutdowns are being avoided.

22-581. **Aids to Aluminum Spot Welding.** Norman Grande. *Welding Engineer,* v. 30, Oct. '45, pp. 44-45, 83.

Automatically indexing feed table that positions spots exactly 0.502 in. apart.

22-582. **Good Welds in a Hurry.** Arthur Havens. *Welding Engineer,* v. 30, Oct. '45, pp. 46-47, 53.

Even when time is short and conditions are far from ideal, broken locomotive frames can be satisfactorily arc welded. Examples.

22-583. **Better Jobs from Flame-Cutting.** A. F. Chouinard. *Welding Engineer,* v. 30, Oct. '45, pp. 48-50.

Bevel cuts, tip sizes, problems of multiple cutting are covered.

22-584. **Electrical Characteristics of Spot Welding Machines.** C. L. Railton and A. J. Hipperson. *Iron Age,* v. 156, Oct. 25, '45, pp. 59-64.

Efforts to improve the strength, consistency of results and quality of spot welds have in the past overlooked the importance of throat dimensions. Results of tests reported show that an increase in welding current of 76%, representing an increase in welding heat of 320%, is obtained by using the machine at its minimum throat as against maximum throat.

22-585. **Spot Welding Stainless Steel.** C. B. Smith. *Western Metals,* v. 3, Oct. '45, pp. 13-16.

Shows typical machine setups used for welding stainless steel aircraft parts. Tables give welding machine settings, required weld shear strengths and design data.

22-586. **Proper Hard Facing of Manganese Steel Castings.** *Western Metals,* v. 3, Oct. '45, p. 19.

Summarizes large manganese steel casting problems.

22-587. **Some Developments in Oxy-Acetylene Applications.** G. E. Bellew. *Iron & Steel Engineer,* v. 22, Oct. '45, pp. 62-65.

New processes that have provided methods of increasing production while reducing time and costs.

22-588. **Multiple Arc Simplifies Welding of Aluminum Sheet.** M. R. Rivenburgh and C. W. Steward. *Product Engineering,* v. 16, Nov. '45, pp. 733-735.

Properties of butt welded joints in high strength aluminum alloy sheets, as produced by a new, easily controlled arc welding process; production advantages indicated.

22-589. **Spot and Seam Welding Aluminum, Part II.** O. A. Perry. *Light Metal Age,* v. 3, Oct. '45, pp. 8-11, 46.

Design for spot welding.

22-590. **Light Welding.** *Automobile Engineer,* v. 35, Oct. '45, pp. 409-414.

Machines and methods employed by Vauxhall Motors, Ltd. Methods of welding the cab for a Bedford truck are described in some detail. Data are given for electrode tip diameters and pressures.

22-591. **Brazing—for Strength With Economy.** Lawrence D. Jennings. *Aero Digest,* v. 51, Nov. 1, '45, pp. 70-71, 176.

Method consists of: Selecting the type of joint most suitable for the application in regard to strength, conductivity, and space limitations. Selecting the brazing alloy most suited for the material being joined in regard to brazing temperature, strength of joint, and method of application. Selecting the method of cleaning, mechanical or chemical, and selecting the method of heating.

22-592. **Cost Reduction Aspects of Flame-Cutting Operations.** G. V. Slottman. *American Machinist,* v. 89, Nov. 8, '45, pp. 98-101.

Design of parts, handling of material, and utilization of scrap are cited.

22-593. **Examination of Welded Joints by Trepanning With Special Application to Shipbuilding.** J. B. Arthur and M. H. MacKusick. *Welding Journal,* v. 24, Oct. '45, pp. 895-901.

Cites advantages and disadvantages.

22-594. **The Heliarc Welding Process as Applied in the Aircraft Industry.** Thomas E. Piper. *Welding Journal,* v. 24, Oct. '45, pp. 903-906.

Wing tips, nose-cradle, instrument panel, spoilers, pulley brackets, hydraulic reservoir and many other small parts made of magnesium and aluminum alloys as well as stainless steel collector rings and exhaust stacks are fabricated by Heliarc welding.

22-595. **Railroad Tank Cars of All-Welded Aluminum.** R. E. Haas. *Welding Journal,* v. 24, Oct. '45, pp. 907-909.

Construction of the 31-ft., 4-in. long by 87-in. diameter structures to rigid specifications is made possible by the automatic carbon arc process and manual welding with metallic aluminum electrodes. Tank shell is made up of three pieces of formed aluminum, square sheared and butted to form a joint with a gap of about $\frac{1}{32}$ in. and no greater than $\frac{1}{16}$ in.

22-596. **Some Conclusions Regarding Resistance Welding and Statistical Quality Control.** John Bayard Butler. *Welding Journal,* v. 24, Oct. '45, pp. 909-914.

Groups of resistance welds can be made whose strength characteristics closely approximate a normal grouping. Therefore users of resistance welding equipment should realize that they can apply statistical quality control to the output of their machines and should examine the possibility of using statistical quality control methods to improve their product and increase their output. 9 ref.

22-597. **Spot Welding of Heavy Aluminum Alloys.** C. W. Dodge. *Welding Journal,* v. 24, Oct. '45, pp. 915-921.

Data given and laws propounded have been verified experimentally with hundreds of tests on aluminum alloys on different sized machines. A machine which has a guaranteed range of 0.016 to 0.081 will easily produce optimum welds on 0.032, 0.040 and 0.051 but not on 0.016 or 0.081. A machine whose guaranteed range is 0.032 to 0.125, on the other hand, produces optimum welds on 0.064, 0.072 and 0.081 but not on 0.032 or 0.125. Likewise, a machine having a range of from 0.064 to 0.187 will produce optimum welds on 0.091 through 0.125 but not on 0.064 and 0.187.

In every case, where the magnitudes of all factors of a machine could be adjusted to those desired as determined from the above laws to produce an optimum weld, the size and shape of the weld produced was exactly the same as that predicted and the latitude of all adjustments was very wide with little of the undesirable effects described.

22-598. **Some Fundamentals in All-Welded Ship Construction.** Milton Forman. *Welding Journal,* v. 24, Oct. '45, pp. 923-928.

Ship failures; cause of failures; crack arrestors; residual stresses; reaction stresses; stress risers and stress concentrations; workmanship; rigidity; absence of crack stoppers in all-welded ships; wartime operating conditions; S.S. "sea porpoise". 10 ref.

22-599. **Chemical Factors Affecting the Welding Properties of Stabilized 18-8 Stainless Steel.** Franklin H. Page. *Welding Journal,* v. 24, Oct. '45, pp. 929-932.

208 heats of Type 321 titanium-stabilized stainless steel and 36 heats of Type 347 columbium-stabilized stainless steel were rated as to their relative weldability and these results correlated against the chemical composition and other data. Results of this investigation indicate that the cost of welding stabilized stainless steels using oxy-acetylene or atomic hydrogen may be materially decreased by slight changes in the chemical composition within existing specifications.

22-600. **Resistance Welding for Economy and Quality.** Lester A. McIntosh. *Welding Journal,* v. 24, Oct. '45, pp. 933-937.

Problem discussed arose through the necessity of reducing cost and increasing the strength of the front axle support for Ford-Ferguson farm tractors. After several months of development and testing, only one of the many submitted designs compared favorably with the original casting on economy and quality. This new design proved to be a riveted assembly of the rear portion of the support which was made from ¼-in. thick steel and the front portion of the support made from $\frac{3}{16}$-in. thick steel requiring eight ½-in. diameter steel rivets. Front and also the rear portions of this support were each in turn reinforced with a ½-in. steel plate at the axle pivot pin to give a greater area of bearing at this vital point. These two reinforcements each required three ½-in. diameter rivets thus making a total of 14 rivets in the completed assembly.

22-601. **Electric Eye Tracing in Machine Cutting.** Walter Bergerow. *Welding Journal,* v. 24, Oct. '45, pp. 941-948.

Electronically controlled steel cutting as possessing flexibility, accuracy, economy and quality, far superior to conventional methods of guiding machine torches. Intricate shapes or contours, impossible to cut with other types of tracing devices, may be cut to dimension with this fully automatic equipment.

22-602. **The Development of a Welding Laboratory.** *Welding Journal,* v. 24, Oct. '45, pp. 481s-485s.

Weldability of steels; welding electrodes; resistance welding; flame pressure welding; welding techniques; structural welding; gas welding, flame cutting, flame hard-

ening; facilities and equipment; brazing and soldering; personnel in welding research. 11 ref.

22-603. **Effect of Recent Research on the Weldability and Control of the Production of Steel Aircraft Tubing, Part I-II.** Arthur J. Williamson. *Welding Journal,* v. 24, Oct. '45, pp. 485s-496s.

Standard sample—cracking measurements; dilatometer studies; metallographic studies; effect of steelmaking practice—aluminum; aluminum vs. cracking-effect of sulphur; cracking of NE steels; post heating; hardness vs. cracking; steel aircraft tubing.

22-604. **Effect of Phosphorus on the Properties and Welding Characteristics of Arsenical and Non-Arsenical Copper and on Copper-Silver Alloy Filler Rod.** Maurice Cook and Edwin Davis. *Welding Journal,* v. 24, Oct. '45, pp. 497s-506s.

Scope of investigation; preparation of materials; mechanical properties, work hardening and annealing characteristics; physical and mechanical properties of 1% copper-silver alloys; weld tests on $\frac{9}{16}$ in. thick plate; effect of phosphorus content upon grain growth in basis metal; weld tests with copper-silver filler rods of various phosphorus contents.

22-605. **Production Technique and Quality of Flash Welded Joints.** Hans Kilger. *Welding Journal,* v. 24, Oct. '45, pp. 506s-520s.

Influence of upsetting on the fatigue strength; relation between the welding procedure and the properties of the joints; influence of the size and shape of the welded cross section. (Second part of the translation of Fertigungstechnik und GuteAbbrenngeschweisster Verbindungen.)

22-606. **The Spot Welding of NE8715, NE8630 and SAE 4340 in the 0.125-In. Thickness.** W. F. Hess, W. D. Doty and W. J. Childs. *Welding Journal,* v. 24, Oct. '45, pp. 521s-530s.

Describes work done in establishing optimum conditions for making tempered spot welds in three different type steels in the 0.125-in. thickness. This work is a continuation of similar investigations on steels of various grades mainly in the 0.040-in. thickness. It is shown that great improvements in the mechanical properties of the welds are obtained through tempering in the welding machine. The greater the hardenability of the steel, the more will the mechanical properties be improved. This process makes it possible to spot weld steels which would be unweldable using conventional methods of spot welding. 6 ref.

22-607. **Instrumentation of the Spot Welder and Investigation of the Spot Welding of 0.091-In. 24S-T Alclad Sheet.** R. C. McMaster and N. A. Begovich. *Welding Journal,* v. 24, Oct. '45, pp. 531s-556s.

Presents preliminary results of a study of the spot welding of wire-brushed 0.091-in. 24S-T Alclad aluminum alloy sheet. Results are typical of those obtained for 0.080 to 0.125-in. sheets. Description is given of a toroid-integrator system used to measure welder secondary current without the loss in energy inherent in a manganin shunt system.

A technique is presented for producing sound welds of 2900-lb. shear strength in 0.091-in. material. 7 ref.

22-608. **Photoelastic Investigation of Stress Distribution in Transverse Fillet Welds.** C. H. Norris. *Welding Journal,* v. 24, Oct. '45, pp. 557s-560s.

Object and scope of investigation; description of tests; discussion of test results.

22-609. **Soft Soldering.** Morris E. Fine and Ralph L. Dowdell. American Society for Metals Preprint 9, 1945, 29 pp.

Soldering properties of lead-tin, lead-antimony-arsenic, and other solders. Properties studied were soldering temperature, drossing, fluxing, wetting, alloying, and strength of steel lap joints. 32 ref.

22-610. **Resistance Welding, Part III.** R. W. Ayers. *Aircraft Production,* v. 7, Oct. '45, pp. 490-494.

Survey of the seam welding process and equipment.

22-611. **Portable Spot Welding Equipment.** *Aircraft Production,* v. 7, Oct. '45, p. 502.

Halves number of operations on bomb-door assembly.

22-612. **Projection Welding for Short Runs.** R. O. Klenze. *Machine Design,* v. 17, Nov. '45, pp. 101-106.

Use of inexpensive fixtures on press type resistance welders, in a manner comparable to a punch press with various die sets, makes possible improved design, increased production and lower costs. A wide variety of cast and forged parts can be redesigned for resistance welding. Cost comparisons on some jobs have shown substantial savings on quantities as low as a thousand parts.

22-613. **Welded Airscrew Hubs.** W. M. Imrie. *Engineers' Digest* (American Edition), v. 2, Oct. '45, pp. 502-505. *Aircraft Production,* v. 7, No. 79, May '45, pp. 210-215.

Method of manufacture eliminating waste is to hot-press the hub in halves from plate and then weld these about a center-line by the flash-butt welding process.

22-614. **The Welding of Non-Ferrous Metals, Part VII.** E. G. West. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1793-1796.

Welding of aluminum and its alloys. 10 ref.

22-615. **Weld Cracks in Mg-Mn-Ce Alloys.** H. Mader and F. Laves. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1797-1800.

It is known that the mechanical properties of magnesium-manganese alloys are considerably improved by the addition of cerium, which, however, reduces their weldability. Tests have shown that weld cracks can be completely eliminated by the addition of aluminum. If the alloy contains a minimum of approximately 1% aluminum, the sheet is fully weldable. Tendency to weld cracking was investigated by the Fokke-Wulfe clamped-weld test.

22-616. **Furnace Brazing With Aluminum Brazing Sheet.** *Sheet Metal Industries,* v. 22, Oct, '45, pp. 1801-1803.

Consists of an aluminum alloy core with a brazing alloy coating, on one or on both sides, metallurgically bonded to the core. When heated above the melting point of the coating alloy and below the melting point of the core, in the presence of an appropriate flux, a portion of the coating will melt and flow into the nearest capillary spaces.

22-617. Oxy-Acetylene Pressure Welding. *Machinery* (London), v. 67, Oct. 4, '45, pp. 365-370.

In process developed by the Linde Air Products Co. temperatures of 2100 to 2300° F. are employed. Pressures of 2500 to 4500 psi. are applied to effect upsetting as parts attain proper degree of heat. Process is especially adaptable to welding of high-carbon and alloy steels.

22-618. The "Electric-on-Oxy" Technique. E. Fuchs. *Welding,* v. 13, Oct. '45, pp. 389-396.

Applied to the welding of thick-walled pipelines.

22-619. Spot Welded Joints. A Survey of Available Mechanical Tests. A. J. Hipperson. *Welding,* v. 13, Oct. '45, pp. 397-408.

Some of the more important mechanical tests for spot welded joints discussed from the point of view of the significance of the numerical data obtained. It is shown that standardization of test specimens is necessary.

22-620. New Metallic Arc Welding Process. *Welding,* v. 13, Oct. '45, pp. 410-414.

Applications of the "Lincolnweld" automatic equipment.

22-621. Welding in Colliery Maintenance. T. S. Glasper. *Welding,* v. 13, Oct. '45, pp. 415-417.

Examples of typical repair work.

22-622. Rigid Frames. Part 4. A Type of Construction Suitable for Welding. J. Corston MacKain. *Welding,* v. 13, Oct. '45, pp. 418-422.

Discusses the erection of a four-span building of north light construction.

22-623. Resistance Welding Prior to Porcelain Enameling. Clyde G. Bassler. *Better Enameling,* v. 16, Nov. '45, pp. 8-9.

Proper equipment and control in fabrication by welding essential for good porcelain enameling conditions.

22-624. Welding and Annealing Stainless Steels. H. C. Esgar. *Western Metals,* v. 3, Nov. '45, pp. 13-15.

Describes main groups of stainless steel and indicates briefly best practice for welding and annealing.

22-625. Flux Bath Brazing of Aluminum Parts. Maurice Beam. *Steel,* v. 117, Nov. 12, '45, pp. 126-127, 190, 192.

Resumé of a furnace aluminum brazing method resulting in accuracy and neatness of completed joints.

22-626. Cold Riveting, for Maximum Strength. *Steel,* v. 117, Nov. 12, '45, pp. 145, 148.

Superior physical characteristics and lowered costs attained through elimination of heating.

22-627. U. S. Navy Developments in Underwater Cutting. Bela Ronay and Cyril D. Jensen. American Society of Naval Engineers *Journal,* v. 57, Nov. '45, pp. 456-480.

Investigation to modernize arc-oxygen cutting resulted in: New electrode design; new torch design; simplification of the technique for using the new materials; standardization of the new procedure; improved safety features in applying the procedure and performance equal to that obtainable with oxy-acetylene in air. Procedure given.

22-628. **Welding Galvanized Steel.** *Iron Age,* v. 156, Nov. 15, '45, pp. 64-65.

For highest tensile strength in galvanized steel welds, a "short sharp heat" with mechanical pressure on as soon as the electrode comes down should characterize spot-welding machine settings. (From *Sheet Metal Industries.*)

22-629. **Welding in Passenger-Car Maintenance.** H. A. Grohe. *Railway Mechanical Engineer,* v. 119, Nov. '45, pp. 484-488.

A catalogue and discussion of many repairs which can be made advantageously by welding. These include repairing broken castings and restoring damaged exteriors and worn parts.

22-630. **Use of Welded Parts Can Be Extended.** George E. Bennett. *Railway Mechanical Engineer,* v. 119, Nov. '45, pp. 516-518.

Observation of welding practices and equipment in the builders' plants leads to the conclusion that the railroads can profit by the new methods.

22-631. **More All-Welded Boilers to Be Built.** E. H. Heidel. *Railway Mechanical Engineer,* v. 119, Nov. '45, pp. 527-537.

Traces history of earliest developments, the welded boiler code and includes details of construction.

22-632. **Copper Brazing Assembly.** *Steel,* v. 117, Nov. 19, '45, p. 132.

Use of a two-piece copper brazing assembly method at Glenn L. Martin Co. makes possible a saving of 13 cents per part on standard cam followers.

22-633. **The Athyweld Process.** *Edgar Allen News,* v. 24, Nov. '45, pp. 513-514, 515.

What it is; application of process; single point lathe tools or similar.

22-634. **Stack Cutting of Thin Sheets Produces Parts of Identical Contour.** G. V. Slottman. *American Machinist,* v. 89, Nov. 22, '45, pp. 122-125.

Methods of aligning, clamping and starting cuts on stacks of plates and sheets are reviewed.

22-635. **Better Jobs From Flame Cutting. Part 3.** A. F. Chouinard. *Welding Engineer,* v. 30, Nov. '45, pp. 42-45.

Gives simple rules for quick calculation of cutting-oxygen volume requirements and cutting-speed settings for a given plate thickness.

22-636. **Economics of Arc Welding. Part 1.** Walter J. Brooking. *Welding Engineer,* v. 30, Nov. '45, pp. 46-51.

Discusses eight chief factors which affect welding costs. These factors are universal in arc-welded fabrication, and the cost advantages of welding depend upon keeping them under proper control.

22-637. **Welded Farm Buildings.** T. B. Jefferson. *Welding Engineer,* v. 30, Nov. '45, pp. 52-54, 56.

Barns, machine sheds, shops and other agricultural buildings which can be fabricated on the site by welding standard structural steel members.

22-638. **Silver-Brazed Brake Cylinders.** *Welding Engineer,* v. 30, Nov. '45, p. 64.

All-steel cylinders fabricated by silver brazing beat magnesium castings in strength and cost, match them equally in weight.

22-639. **Special Length Boiler Tubing Fabricated by Pressure Welding.** *Industry & Power,* v. 49, Nov. '45, pp. 75-76.

Either standard length tube stock or short lengths can be joined together by process employing oxy-acetylene heating and pressure from hydraulic pump to upset joints and produce welds.

22-640. **Oxy-Acetylene Cutting Tactics for Various Alloy Steels.** G. V. Slottman. *American Machinist,* v. 89, Dec. 6, '45, pp. 102-104.

Correct cutting procedures described.

22-641. **Tube-Welding Fixtures Allow for Distortion.** E. H. Farmer. *American Machinist,* v. 89, Dec. 6, '45, pp. 122-124.

Engine mounts and support bays held to close tolerances for interchangeability. Welding in one pass avoids cracks in joints. Parts are upset or drawn to size.

22-642. **Welding Aluminum and Aluminum Alloys.** *Aluminum & the Non-Ferrous Review,* v. 10, July-Sept. '45, pp. 46, 48-50.

Welding properties of aluminum; joint design for aluminum welds; preparation for welding; use of flux; cleaning and finishing; control of the puddle; welding sheet aluminum; welding aluminum plate; heavy plates and castings.

22-643. **Welding Mild Steel.** H. O. Westendarp, Jr. *Steel,* v. 117, Nov. 26, '45, pp. 94-95, 123.

Reference outline covering more important welding conditions and requirements and guide for users of electrodes.

22-644. **Welded Ship Failures Traced.** *Iron Age,* v. 156, Nov. 29, '45, p. 49.

Table gives faulty welding practices and their results.

22-645. **Effect of Three Variables in Spot Welding.** Herbert Van Sciver. *Metal Progress,* v. 48, Dec. '45, pp. 1292-1295.

Discussion of several series of welds made under carefully controlled conditions. In each series, all variables held constant except one which was varied between limits, and its effect on weld strength and formation noted. Variables under control were current, time, tip force, and electrode shape. Of these, all except electrode shape were varied one at a time. High tensile stainless steel (18-8) sheet 0.075 in. thick chosen for demonstration since quantities affecting weld are of such magnitude as to be easily varied.

22-646. **Types of Resistance Welding Work.** F. R. Woodward. *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 301-302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328.

Product design considerations; spot welding; multiheat timing controls; spot welding machines; electrode materials; electrode usage; electrode design; determination of welding set-up; positioning devices; machine maintenance.

22-647. **Induction Heating Brazes Tool Tips.** T. A. Vernor and E. F. Adams. *Machine Tool Blue Book,* v. 41, Nov. '45, pp. 330, 332, 334, 336, 338, 340.

Recent installation at the Reed Roller Bit Co., Houston, Texas, brazes alloy tool tips onto single point tools in a fraction of the time formerly required with acetylene gas torches.

22-648. **Soft Solder Selection Aided by Simple Test.** E. E. Schumacher, G. M. Bouton, and G. S. Phipps. *Materials & Methods,* v. 22, Nov. '45, pp. 1407-1410.

Method of testing wetting ability of soft solder. 5 ref.

22-649. **Carbon Arc Welding of Aluminum Speeds Fabrication.** W. J. Conley. *Materials & Methods,* v. 22, Nov. '45, pp. 1423-1425.

Efficiency of procedures described evidenced by fact that, currently, rejects amount to only about 5%, all of which are corrected. Average production per machine is about 30 completed deck balk per 9-hr. shift with trend being on upgrade as the operators become more efficient.

22-650. **Flame-Gouging of Steel Castings.** A. E. Blake. *Materials & Methods,* v. 22, Nov. '45, pp. 1428-1431.

Defects in steel castings removed effectively in any ferrous structure up to 0.40% carbon, by means of gas flame.

22-651. **Hard-Surfacing Methods.** *Materials & Methods,* v. 22, Nov. '45, p. 1459.

Types of hard-surfacing materials; arc method; oxy-acetylene method; general considerations.

22-652. **Hints for Better Spot Welding.** T. A. Beck. *Sheet Metal Worker,* v. 36, Nov. '45, pp. 88, 104.

Schedule for changing electrodes; spot spacing; placing new tips into holder; three common causes of rejects.

22-653. **Production Riveting by Machine.** J. E. Cooper. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 494-497.

Some modern methods and their advantages.

22-654. **Building Up Worn Marine Shafts.** *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 502-503, 535.

Application of Metallizing process. Restores surface to new condition in a few hours of labor.

22-655. **Aluminum Bronze Welding in Steel Plant Maintenance.** F. E. Garriott. *Iron & Steel Engineer,* v. 22, Dec. '45, pp. 98-102.

Aluminum bronze alloys, which have proven themselves in parts of equipment subject to wear or corrosion, have equally valuable maintenance applications as coated electrodes for metallic arc, carbon arc and oxy-acetylene welding.

22-656. **The Flash Welding of Steel.** J. C. Barrett. *Iron & Steel Engineer,* v. 22. Dec. '45, pp. 103-115.

Sets forth principles of flash welding and illustrates their applications to modern production problems.

22-657. **Induction Heating Brazes Tool Tips.** *Tool & Die Journal,* v. 11, Nov. '45, p. 105.

Brazes alloy tool tips into single point tools in a fraction of the time formerly required with acetylene gas torches.

22-658. **Brazing Carbide Tips to Cutter Bodies.** Raymond O. Catland. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 486-489.

Discusses gas or acetylene torch brazing, furnace brazing, and use of high frequency induction electric current to supply heat.

22-659. **Production Riveting by Machine.** J. E. Cooper. *Western Machinery & Steel World,* v. 36, Nov. '45, pp. 494-497.

Up to 12 rivets upset at one stroke by General multiple riveter ram, which is actuated by a hydraulic system, has double action stroke. Hydraulic system has a capacity of 1000 psi. Instrument is self-compensating for changing material thicknesses with the use of especially designed monorail conveyor. It is possible for one person to rivet large wing sections 26 ft. long. A woman can rivet 3000 rivets in 1 hr. 5 min. Same job would have required the services of four riveters for 2 hr. apiece using the hand method.

22-660. **Underwater Welding.** John R. Morrill. *Steel,* v. 117, Dec. 3, '45, pp. 112-113, 153.

Techniques developed for salvaging sunken vessels to be useful in repairing damaged ships, underwater pipe, tanks and other industrial installations.

22-661. **Welding and Brazing Combined Form New Uses for Steel Stampings.** *Steel Processing,* v. 31, Nov. '45, pp. 699-702.

Proper design of stamped and machined parts will permit combined use of welding and brazing. Resistance or spot welding is used to hold the various parts in position for brazing, thus eliminating use of jigs, and expense of heating jigs during brazing.

22-662. **Welding Aids Completion of Vital War Project.** *Steel Processing,* v. 31, Nov. '45, pp. 712-713.

Unique design of tanks required a fabricating procedure that would render structures absolutely leak-proof and air-tight since their purpose was to receive and store dangerous emanations or residual matter that remained after scientific atom-harnessing operations.

22-663. **Oxy-Acetylene Pressure Welding of Boiler Tubing.** *Industry & Welding,* v. 18, Nov. '45, pp. 37-38, 89.

Boiler tubing, tailor-made to any desired length, fabricated from standard-length tube stock by the use of oxy-acetylene pressure welding. Besides welding short lengths of tubing to standard 20-ft. lengths, boiler manufacturer also uses process to join together standard lengths. Continuous tubing 95 ft. in length has been produced. Production delays now avoided since tube stock of suitable length is readily available.

22-664. **Welded Monel Overlays on Heavy Parts.** *Industry & Welding,* v. 18, Nov. '45, pp. 52-54.

When big, heavy sections must be made of steel or iron instead of corrosion resistant material, critical surfaces can be protected against abrasion, erosion and corrosion by the overlaying methods explained. Same general procedure can be used to build up worn or corroded parts.

22-665. **Why Fabricated Supporting Units Replace Castings.** Charles B. Bednar. *Industry & Welding,* v. 18, Nov. '45, pp. 46-47, 90-95.

Sets forth advantages of welded steel construction in machine and engine building and reveals need for expert design, manufacturing skill, and production facilities.

22-666. **Reclaiming Worn Track Links.** *Industry & Welding,* v. 18, Nov. '45, pp. 39, 95-96.

How worn tractor grousers and track links are rebuilt with arc welding.

22-667. **Resistance Welding Machines.** C. A. Burton. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1979-1986.

Power supply, installation, and servicing.

22-668. **Welding of Non-Ferrous Metals. Part VII.** E. G. West. *Sheet Metal Industries,* v. 22, Nov. '45, pp. 1987-1992, 1994.

Fusion welding processes for aluminum and its alloys. 19 ref.

22-669. **Gear Production Problems Solved by Automatic Welding.** R. P. Sharer. *Machinery,* v. 52, Nov. '45, pp. 153-155.

Gears, originally made of cast steel, were first welded manually; later automatic welding by the "Lincolnweld" method was adopted. Highest production efficiency obtained at lower cost.

22-670. **Stack-Cutting Provides Fabricating Short-Cuts.** *Machinery,* v. 52, Nov. '45, pp. 160-162.

Shows an impressive saving in production time and cost compared with the use of dies for stamping out similar shapes on a press. Successful machine cutting of stacked sheets is largely dependent upon the care used in preparing and setting up the work.

22-671. **Automatic Positioning Control Speeds Welding.** *Machinery,* v. 52, Nov. '45, pp. 176-178.

Using an adjustable-speed drive with a welding positioner, appreciable reductions in set-up and handling time have been obtained.

22-672. **Spot and Seam Welding Aluminum. Part 3.** O. A. Perry. *Light Metal Age,* v. 3, Nov. '45, pp. 8-11, 48.

Spot welding quality control.

22-673. **The Estimation and Influence of Hydrogen in Weld Metal.** E. C. Rollason and H. W. Mance. *Welding,* v. 13, Nov. '45, pp. 436-440, 461.

Methods of determining hydrogen content of weld metal, influence of hydrogen in welding and the embrittlement theory. Typical hydrogen analyses for weld metal included. 7 ref.

22-674. **Production of Service Trucks.** *Welding,* v. 13, Nov. '45, pp. 441-450.

Equipment and procedures of welding department of Vauxhall Motors, Ltd.

22-675. **Mobile Power Stations.** *Welding,* v. 13, Nov. '45, pp. 457-461.

Details of assembly of mobile power stations. Both automatic and manual arc welding are employed.

22-676. **Strength of Spot Welds in Lead, Lead Alloys and Terneplate.** J. Heuschkel. *Product Engineering,* v. 16, Dec. '45, pp. 872-876.

Optimum spot welding conditions and properties of welds obtainable between various thicknesses of lead and lead alloys given; describes number of experiments and tests leading to establishment of definite production standards for spot welding of these metals to themselves and to terneplate.

22-677. **Automatic Welding Action.** *Steel,* v. 117, Dec. 17, '45, p. 122.

Insures speed, quality, clean welds, and freedom from stress.

22-678. **Resistance Welding Prior to Porcelain Enameling.** Clyde G. Bassler. *Finish,* v. 2, Dec. '45, pp. 19-21, 52.

Spot welding; requirements for producing the right spot weld; projection welding; roll seam welding; welding speeds; flash-butt seam welding.

22-679. **Flash Welding Fills a Need.** Gilbert C. Close. *Modern Machine Shop,* v. 18, Dec. '45, pp. 140-142, 146, 148, 150, 152, 154, 156, 158.

Precise and economical method of fabrication.

22-680. **Automatic Welding Hastened Atomic Bomb Development.** *Machine Tool Blue Book,* v. 41, Dec. '45, pp. 209-210, 212, 214.

Discusses its application to metal fabricated part of tank.

22-681. **Metallizing as a Production Process.** *Iron Age,* v. 156, Dec. 13, '45, pp. 72-73.

Various applications described.

22-682. **The Application of Pressure Welding to the Manufacture of Aircraft Landing Gear.** E. R. Proctor. *Welding Journal,* v. 24, Nov. '45, pp. 1011-1017.

Preliminary investigation made with specimens welded on an experimental welding machine. Result of engineering study is complete range of welding machines capable of welding tubular joints in sizes ranging from 1 in. diameter up to and including 20 in. diameter. Production 6-in. welding machine shown.

22-683. **Maintenance and Repair of Oil Pipe Lines.** Oliver Wildman. *Welding Journal,* v. 24, Nov. '45, pp. 1019-1021.

Procedures and methods of repair.

22-684. **War-Proved Advances in Low-Reactance Cable.** Myron Zucker. *Welding Journal,* v. 24, Nov. '45, pp. 1022-1026.

Technical details. Some of test methods by which various features were compared and improved.

22-685. **Economics of Arc Welding.** Walter J. Brooking. *Welding Journal,* v. 24, Nov. '45, pp. 1027-1033.

Relationships of several important factors common to all welding applications which greatly affect total cost of welded structure. Design to reduce welding and deposited weld metal; plan to utilize material to best advantage; quick setting up fixtures to eliminate hand measuring; using the most economical size of electrode; good fitup of welded joints compared to poor fitup; good operator factor.

22-686. **Application of Capacitor Discharge to Welding.** H. J. Bichsel and J. R. Parsons. *Welding Journal,* v. 24, Nov. '45, pp. 1035-1039.

Description of system; kva. demand; forging; types of machines and control; future trends. 5 ref.

22-687. **Welding of Propulsion Shafting.** Hugo W. Hiemke and James C. Blake. *Welding Journal,* v. 24, Nov. '45, pp. 1040-1045.

Shafting from formed and welded plate; centrifugally cast and welded shafting; comparison of forged and centrifugally cast shafting; quality control and inspection; testing of the cylindrical castings; development of physical properties; development of flanges; development of welding procedure; radiographic and magnaflux examination of castings and welds; torque testing of finished shafting.

22-688. **Welding of Combat Vehicles.** L. M. Dalcher. *Welding Journal,* v. 24, Nov. '45, pp. 1046-1051.

Design of combat vehicles; welding controls; review of contractors' welding procedures; qualification tests of welding procedures; standardization in ordnance welding; standard form for recording welding procedures; adaptability to commercial non-ordnance welding.

22-689. **Emergency Repair of Magnesium Parts by Gas Welding.** *Welding Journal,* v. 24, Nov. '45, pp. 1051-1052.

Materials and equipment; field repair of magnesium castings; welding of castings to wrought parts; field repair of wrought magnesium; cleaning and painting.

22-690. **Welding of LST's at Seneca, Ill.** L. C. Stiles. *Welding Journal,* v. 24, Nov. '45, pp. 1053-1060.

Briefly describes ship and facilities for its construction.

22-691. **Determination of Labor Costs in Electric Arc Welding.** J. L. Cahill. *Welding Journal,* v. 24, Nov. '45, pp. 1060-1062.

Variables include weld size, electrode type, size and application, basic labor cost and the operation factor. Tables give weight per foot and minimum deposition rates.

22-692. **The Straining of Deposited Weld Metal During Cooling.** E. Paul DeGarmo. *Welding Journal,* v. 24, Nov. '45, pp. 561s-563s.

In a butt Unionmelt weld greater than 20 in. in length weld metal at the midlength is subjected during cooling to a plastic strain greater than that corresponding to the yield point of material. Maximum effect of such straining upon tensile properties of weld metal is less than that of ½% plastic strain at room temperature. 4 ref.

22-693. **Weldability Tests of Cast Steels.** Frank S. McKenna and Clarence E. Jackson. *Welding Journal,* v. 24, Nov. '45, pp. 573s-579s.

T-bend and nick-bend tests recommended as direct quantitative tests for determining the effect of changes in welding technique and heat treatment on the ductility of cast steels and for indicating relative weldability of cast steels of any composition. Stress-relief anneal subsequent to welding, in general, greatly improves the weld ductility; preheat is necessary to prevent under-bead cracking in certain compositions of cast steel. 3 ref.

22-694. **Some Causes of Brittle Failures in Welded Mild Steel Structures.** H. E. Kennedy. *Welding Journal,* v. 24, Nov. '45, pp. 588s-598s.

Following factors influenced cracking of welded steel plates: Temperature; welding stresses; heat treatment after welding; preheating; thickness; mechanical discontinuities; welding voltage; geometry; methods of loading.

SECTION XXIII

INDUSTRIAL USES AND APPLICATIONS

23-1. **Control of Tool Production and Maintenance.** F. Cook. *Machinery* (London), v. 65, Nov. 23, '44, pp. 576-580.

Tool room system. Control of tool manufacture; tool-room work performed elsewhere; tool maintenance; stock tools.

23-2. **Vale Die Set and Stripper.** *Machinery* (London) v. 65, Nov. 23, '44, pp. 581-584.

Die set which minimizes tool-making work, while retaining the desirable features of pillar-type tools, and provides for interchangeability of the punches and dies.

23-3. **Disc Brakes.** *Automobile Engineer,* v. 34, Dec. '44, p. 529.

A variety of types for light or heavy vehicles.

23-4. **New Tanks for Old Ones.** *Modern Industrial Press,* v. 6, Dec. '44, pp. 9-10.

In a thoroughly modern factory, where not so many months ago deft, sleek machines poured out and packaged millions of rounds of small arms ammunition, towering cranes and frames today go about one of the most fascinating jobs that the war has produced—that of rejuvenating and rebuilding worn and damaged tanks for battle service.

23-5. **Wire Woven Belt Production.** *Wire Industry,* v. 2, Dec. '44, pp. 615, 618.

Ideal driving medium; forming the wire spirals; applying the surface contact material.

23-6. **Indium in Aviation.** William S. Murray. *Aircraft Engineering,* v. 16, Nov. '44, pp. 332-333.

Decorative finishes; brazing alloys; bearings; new indium alloy coating approved for use on steel airscrew blades; process used in factory; preparation of surface for paint used as camouflage following application of indium alloy coating; advantages of indium alloy coatings. (Paper read at 12th Meeting of the Institute of the Aeronautical Sciences, New York, 1944.)

23-7. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 7, Dec. '44, pp. 565-566.

Detailed consideration of the theory and practice of electrolytic condensers.

23-8. **Light Alloys in Civil Engineering.** *Light Metals,* v. 7, Dec. '44, pp. 582-606.

The value of light alloys in immobile structures lies in the high strength-to-weight ratio of these materials; their resistance to corrosion and decay; the readiness with which they respond to certain fabricating operations; and the ease, compared with bricks, concrete, ferrous and other non-ferrous metals, of transportation to the site and of handling during erection.

23-9. **Exacting Production Methods on the Aircraft Gyropilot.** G. A. R. *Machinery* (London), v. 65, Nov. 30, '44, pp. 589-597.

The A-3 Sperry gyropilot is composed of two separate control units called the "gyrohorizon" and the "directional gyro." Exacting methods of machining, assembly, and inspection employed in manufacturing these units described and illustrated.

23-10. **Design of Hydraulic Systems.** Howard Field. *Product Engineering,* v. 16, Jan. '45, pp. 22-26.

Description and analysis of the characteristics, advantages, limitations, and control of the output of types of pumps suitable for use in hydraulic systems. Pumps of the following types are discussed: Centrifugal, gear, vane, and piston.

23-11. **Malleable Castings for Heavy Duty Trucks.** Pat Dwyer. *Foundry,* v. 73, Jan. '45, pp. 68-71, 206.

New foundry operated by Saginaw Malleable Iron Division, General Motors Corp., at Tilton, Ill.

23-12. **Mass Production in Ship-Building.** Howard Campbell. *Modern Machine Shop,* v. 17, Jan. '45, pp. 124-132, 134, 136, 138.

Methods employed by the California Shipbuilding Corporation in the building of Liberty and Victory Ships.

23-13. **Complete Assembly of 57-Mm. Gun Carriages by Pressed Metal Producer.** *Steel Processing,* v. 30, Dec. '44, pp. 780-782.

Production of end-products by stampers is the complete 57-mm. anti-tank gun carriage M1A3 made by the Parish Pressed Steel Co. Assembly steps shown.

23-14. **Some Applications of Welded Aircraft Tubing.** J. S. Adelson and Park Hill. *Steel Processing,* v. 30, Dec. '44, pp. 806-808, 816.

Applications of welded tubing in the power plant. (Presented at annual meeting of American Society of Mechanical Engineers, New York City, Dec. 1, 1944.)

23-15. **Cast Iron Thread Gages.** C. C. Taggart. *Metals & Alloys,* v. 20, Dec. '44, pp. 1607-1610.

Use and performance of the cast iron gages and some of the machining, heat treating and other operations in their manufacture.

23-16. **Gray Iron. . . . Its Economy, Adaptability and Versatility Viewed as an Engineering Material.** R. G.

McElwee. *American Foundryman,* v. 7, Jan. '45, pp. 12-16.

Cooperation between the designing engineer and the foundryman can greatly influence the future use of cast iron as an engineering material.

23-17. **Hercules Sleeve-Valve Engine Production.** *Machinery* (London), v. 65, Dec. 7, '44, pp. 617-625.

The sleeve-valve system of operation, with its smooth continuous sliding motion, replaces the poppet valve system with its multitude of parts and continuous hammer-and-anvil action. The special steel sleeve valve, with its four ports, is positively driven from the crankshaft at half engine speed by an arrangement of simple cranks and gears. A cutaway view of one of the cylinder units, showing the crank-driven sleeve, is given.

23-18. **Tipped High Speed Steel Widely Used, Survey Shows.** Frank J. Oliver. *Iron Age,* v. 155, Jan. 18, '45, pp. 58-61, 137-140.

When the supply of alloying elements for high speed steel became critical, many methods of using this cutting tool material in tip rather than solid form were publicized. To discover to what extent these practices have actually been put to work in industry, a survey was conducted, the results of which are summarized.

23-19. **German Radiators, Oil Tanks and Coolers.** *Aircraft Engineering,* v. 16, Dec. '44, pp. 363-368.

DO 18/D3 Jumo 205C engine—Aluminum oil cooler; Messerschmitt 109F, Mercedes-Benz engine—Aluminum radiator; Junkers 88, Jumo 211 engines—Radiators; Focke Wulf 200 (Condor) B.M.W. engines—Oil cooler; Focke Wulf 200 Condor engine—Oil tank; Radiator unit from Me 210.

23-20. **The Utilization of Engineering Constructional Steels.** E. Simister. *Metallurgia,* v. 31, Dec. '44, pp. 65-69.

Significant metallurgical developments have been made in recent years in the production and utilization of engineering constructional steels. Wartime requirements have necessitated the utmost conservation of steel and all steel-making material, involving a rather drastic conversion to planned economy. Metallurgical progress has facilitated rationalization of steel usage. the advantages of which may insure the retention of its principles, under more normal conditions, for economic reasons alone.

23-21. **Metallurgical Progress in Tin.** John Ireland. *Metallurgia,* v. 31, Dec. '44, pp. 75-79.

Search for, and use of, substitutes and alternatives which scarcity enforces may well serve to bring out the advantages of previously established usage. This is exemplified in such uses of tin as tinplate, solder and bronze, in which recent experience suggests that future progress will be the result of intelligent development of previously established practice.

23-22. **Zinc and Zinc Alloys.** B. D. Darrah. *Metallurgia,* v. 31, Dec. '44, pp. 87-91.

Outlines some of the chief uses of zinc and zinc alloys during the war years; applications of zinc; zinc die-casting alloys; zinc alloy for press dies; molds for plastic molding.

23-23. **Light Metals Versus Plastics.** Ronald Fleck. (*Light Metals,* v. 7, no. 82, Nov. '44, pp. 518-521.) *Engineers' Digest* (American Edition), v. 2, Jan. '45, pp. 40-41.
Comparison of the two industries to discover the essential differences and boundaries.

23-24. **Rapid Production of Finned Tubes.** A. G. Arend. *Machinery* (London), v. 65, Dec. 21, '44, pp. 689-690.
Discussion of various methods.

23-25. **Utilizing the Effects of Cold Setting in Springs.** A. M. Wahl. *Machine Design,* v. 17, Jan. '45, pp. 107-112.
Cold setting has proved advantageous in increasing the life of springs for many types of applications. Analysis of actual spring shows that the reduction of peak stresses may be substantial and indicates why high working stresses may be used in design. 9 ref.

23-26. **Aircraft Bevel Gears.** *Aircraft Production,* v. 7, Jan. '45, pp. 13-18.
Review of types and their applications; design and production considerations.

23-27. **Tolerance for Molded-Plastic Screw Threads.** J. Butler. *Machinery* (London), v. 65, Dec. 28, '44, pp. 713-717.
Difficulties of mating screw threads molded in plastics with metal threads have long been recognized by plastic molders and tool-makers. Modern molding powders, made under controlled conditions, give a shrinkage which for a given grade of powder is constant within reasonably fine limits, so that it is possible to make provision for the shrinkage by cutting mold threads oversize in both diameter and pitch if equipment for cutting non-standard pitch threads is available.

23-28. **Woven Wire Conveyor Design, Part II.** Fred L. Hooper. *Industrial Heating,* v. 12, Jan. '45, pp. 51, 52, 54, 56.
Design, construction, maintenance and operation of industrial woven-wire conveyor belts discussed, with reference to the influence of types of materials from which belts are made, belt construction, and other operating details upon belt life. The steps that can be taken to increase belt life in a given use by adopting various alloy materials to construct belts for specific purposes discussed. The numerous ways in which conveyors can be installed are described and actual installation views are shown to indicate the wide applicability of this mode of handling material during processing of practically all forms of materials.

23-29. **Paid.** Ray Anderson. *Die Castings,* v. 3, Jan. '45, pp. 24, 44, 46.
Judicious use of die castings reduces weight of perforating machines.

23-30. **Get Out of the Way.** R. D. Buell. *Die Casting,* v. 3, Jan. '45, pp. 28, 30.
Use of die castings for high pressure horns.

23-31. **Slow Down.** C. B. Seymour. *Die Casting,* v. 3, Jan. '45, pp. 31-33.
An assembly of die cast parts provides a trouble free, tamper proof governing device.

23-32. **Stop Master.** G. L. LaBar. *Die Casting,* v. 3, Jan. '45, pp. 42-43, 57.
Die castings stand up under severe weather and road conditions; in brake assemblies for the Russian army the ultimate practical test of ruggedness is met.

23-33. **What Torque?** W. C. Stewart. *Fasteners,* v. 1, no. 4, '44, pp. 8-10.
Torque-tension ratio is an important factor in many applications of fasteners—friction gremlins, opposing efforts to produce tension, make this ratio an uncertain quantity.

23-34. **Field Welded Pressure and Variable Volume Storage Tanks.** Fred L. Plummer. *Welding Journal,* v. 24, Jan. '45, pp. 37-45.
In selecting the proper type of large field welded container in which to store a given product, one must consider four major factors: (1) Safety from fire or explosion; (2) maintaining the quality of the product; (3) preventing loss of the product—breathing, filling and boiling losses; (4) cost of initial installation, maintenance and operation. 6 ref.

23-35. **Plant Service Equipment.** *American Machinist,* v. 89, Jan. 18, '45, pp. 339-350, 352.
32nd annual review of trucks and hoists, materials handling accessories, machine drives, couplings, belting and clutches, lighting equipment, fans, heaters, compressors, air cleaners, air cleaning and drafting, drafting and safety equipment, miscellaneous.

23-36. **Parts and Materials.** *American Machinist,* v. 89, Jan. 18, '45, pp. 361-364, 366, 368, 370-372.
Review of electrical controls, bearings, valves and fittings, materials, fastening devices.

23-37. **Three-Piece Mortar Shells Replace Forgings.** John Y. Blazek. *Metal Progress,* v. 47, Feb. '45, p. 273.
Conversion from a forged body for 4.2-in. mortar projectile to a short length of X-1335 seamless steel tubing, a base plug and a nose adapter, all three silver soldered (brazed) together, increased output of badly needed ammunition. Forging machines unnecessary and metal saved.

23-38. **Enemy Matériel From the Metallurgical Point of View.** J. R. Cady, H. W. Gillett and L. H. Grenell. *Metal Progress,* v. 47, Feb. '45, pp. 289-320.
Economic and technical aspects; German shortages; German armor; German projectiles; projectiles with tungsten carbide cores; metal in German guns; Japanese arms and ammunition; general conclusions about ordnance type of scrap used for steel in minor parts;

vital engine parts and valves; engine valves; non-ferrous alloys. 26 ref.

23-39. **Steel in Post-War Technology.** J. B. Austin. *Railway Age,* v. 118, Feb. 3, '45, pp. 272-273.

War-time metallurgical developments such as: (1) The use of boron in steel to enhance hardenability; (2) new knowledge, experience and steel compositions in connection with the use of steel at elevated temperatures; (3) the use of welding as a means of fabrication on many grades of steel that hitherto were considered hardly weldable; (4) the continued use of at least some of the NE steels will be used to advantage in postwar technology.

23-40. **Making 8-Inch Artillery Shells.** *Modern Industrial Press,* v. 7, Jan. '45, pp. 44, 46, 48.

Description of the steps in manufacturing and the accomplishments of one of the first concerns to make larger shells.

23-41. **Manufacture of Robot Bomb Engines.** S. H. Brams. *Iron Age,* v. 155, Feb. 1, '45, pp. 60-61.

Details of manufacturing robot bomb engines at Ford Motor Co.

23-42. **Light Alloy Cylinder Heads from German Aircraft Engines.** *Automotive Industries,* v. 92, Feb. 1, '45, pp. 29, 54, 58.

Metallurgical data obtained by investigation of the composition, construction and properties of three types of light alloy cylinder heads recovered from German aircraft engines.

23-43. **Recent Developments and Trends in Materials and Their Applications.** *Metals and Alloys,* v. 21, Jan. '45, pp. 85-95.

An over-all review of broad developments in the materials field, followed by many short reviews of the individual metals and non-metals that are of major interest to materials engineers, with emphasis on new and improved materials and application trends.

23-44. **Design Selection of Parts and Fabrication Methods.** *Metals and Alloys,* v. 21, Jan. '45, pp. 96-104.

A bird's eye view of the general situation involving the competing fabrication types or production methods from the design standpoint, followed by shorter articles, each reviewing application and design trends for a specific method of fabrication or type of part.

23-45. **Materials for Solving Specific Engineering Service Problems.** *Metals and Alloys,* v. 21, Jan. '45, pp. 104-108.

A comprehensive survey of recent broad trends in design engineering, followed by brief reviews of progress in applying materials to the solution of specific engineering service design problems.

23-46. **Chain-Making Equipment.** *Wire Industry,* v. 12, Jan. '45, pp. 27-29.

Development and processes described.

23-47. **Flame Cleans and Oils Rails for Road Crossings and Tunnels.** *Railway Engineering and Maintenance,* v. 41, Feb. '45, pp. 156-160, 164.

Motivated by an increase in recent years in the number of rail head and web separations occurring in paved road crossings and tunnels, which have been attributed partly to the effects of corrosion, The Norfolk & Western has started the practice of flame-cleaning and oiling all rails destined for use in such locations. Special equipment has been devised for applying this treatment in an effective manner, and somewhat similar equipment has been developed for treating joint bars.

23-48. **Induction Heating in Radio Electron Tube Manufacture.** E. E. Spitzer. Electrochemical Society Preprint no. 86-27, Oct. '44, 16 pp.

The radio electron-tube industry was one of the first to use induction heating extensively. The metal parts of the electron tubes must be heated to 500 to 1500° C. during evacuation in order to liberate gases occluded in the parts. Since the parts are in a vacuum and are usually surrounded by a glass bulb, induction heating is the ideal method of heating. Other similar applications are "getter" flashing and vacuum-firing systems. Still other applications are in sealing metal to glass, in brazing tube parts together, and in welding. Chief advantages are accurate control and speed of heating. The radio-frequency generators generally are of vacuum-tube type operating at about 200 to 500 kilocycles. Units of about 2 to 15 kilowatts are used. The theory of heating is developed from simple air-core transformer considerations and an example is given.

23-49. **Where to Find Special Information on Electronic Uses in Industry.** W. C. White. *Electronic Industries,* v. 4, Feb. '45, pp. 102-105, 172, 174, 176, 178. 180, 182, 184-188, 190, 192, 194.

List of references supplementary to those published in the June 1943 and February 1944 issues. 326 ref.

23-50. **Cast Crankshafts Successfully Used on Large Direct-Reversible Marine Diesels.** *Industry & Power,* v. 48, Feb. '45, p. 69.

Army tugs equipped with 8-cylinder diesels with cast crankshafts have given excellent service during thousands of hours of operation in the various war theatres. Continued research on the casting process may result in reduced costs in the postwar period.

23-51. **Enemy Metallurgical Practice.** *Steel,* v. 116, Feb. 19, '45, pp. 108-111, 154, 156, 158, 160.

This report on German and Japanese progress in metal working is based upon data presented by Col. J. H. Frye of the Office of the Chief of Ordnance before SAE. German practices are described as "efficient and advanced," in sharp contrast with unprogressive, extravagant methods of the Japanese.

23-52. **The Busy Line.** T. Frank Cassidy, Jr. *Die Casting,* v. 3, Feb. '45, pp. 28-31.
The use of die castings had an early start in the pioneer pay station telephone industry. The test of time has made these consistently used parts indispensable.

23-53. **Accounting for Accuracy.** F. E. LeBaron. *Die Casting,* v. 3, Feb. '45, pp. 36-41.
Besides the expected advantages of lower costs, greater accuracy and weight reduction, IBM engineers have found that die castings make many unusual contributions in their designs of business machines.

23-54. **Record Advances in Electronic Recording.** R. L. Stone. *Die Casting,* v. 3, Feb. '45, pp. 46-50.
In the commercial as well as military models of Soundscriber equipment the use of die castings has made possible the design of lightweight, compact, yet extremely rugged units which require no oiling and a minimum of field maintenance.

23-55. **Selection and Maintenance of Magnetic Brakes.** A. E. Lillquist. *Iron and Steel Engineer,* v. 22, Feb. '45, pp. 53-62.
Correct brake selection depends on the requirements of the specific application; proper maintenance and adjustment are essential to satisfactory performance.

23-56. **The Place and Effect of Conveyor Equipment in Industry.** J. E. McBride. *Iron and Steel Engineer,* v. 22, Feb. '45, pp. 70-79.
Conveyor equipment has played a major role in the industrial development of the United States; the steel industry is finding applications for some types of conveyors which were developed for other industries.

23-57. **Aluminum Structures.** *Modern Metals,* v. 1, Feb. '45, pp. 6-7.
Changing trend in structures towards aluminum. A good application for it.

23-58. **Prewar Germany's Light Metals.** Gert Ahrens. *Modern Metals,* v. 1, Feb. '45, pp. 12-14.
Light metal developments in prewar Germany.

23-59. **Piston Rings.** *Automobile Engineer,* v. 35, Jan. '45, p. 28.
Developments in form and material.

23-60. **The Chemical Deposition of Copper Mirrors on Glass.** Evelyn C. Marboe and W. A. Weyl. *Glass Industry,* v. 26, March '45, pp. 119-120, 136-138, 142, 149.
Conditions for the formation of metal mirrors on glass; copper deposition from solutions; copper deposition from solids. 21 ref.

23-61. **Metals Make Railroads.** Fred P. Peters. *Scientific American,* v. 172, March '45, pp. 162-164.
The railroads are planning now to utilize the far-reaching advances made by metals during the war in higher speed, lighter weight rolling stock for both passenger and freight. With this equipment they will meet peacetime competition of the airplane, truck, and bus.

23-62. **The Manufacture of Aircraft Instrument Springs.** J. W. Rockefeller. *Wire & Wire Products,* v. 20, March '45, pp. 189-191, 210.

Making springs for aircraft instruments during the war summed up briefly as doing the impossible—in a hurry. It is doubtful whether there is today, in the United States, a single spring maker who will concede that anything short of accomplishing perpetual motion is beyond the possibilities of a spring.

23-63. **First Aluminum Box Cars Are Delivered.** *Railway Age,* v. 118, March 10, '45, pp. 444-447.

Objectives sought in the design; details of the construction.

23-64. **Installation and Operation of Woven Wire Conveyor Belts: I.** Fred L. Hooper. *Industrial Heating,* v. 12, Feb. '45, pp. 234, 236, 238, 240.

Design, construction, maintenance and operation of industrial woven wire conveyor belts. Special reference to the types of materials available for belt construction, how the type of construction chosen and the inherent heat and corrosion resistance of the selected material affect belt life. Actual installations shown and described to illustrate the practical application of the principles discussed in the earlier sections of the article, in numerous industrial processes.

23-65. **Steel Life Rafts Compartmented Like Battleship.** *Steel Processing,* v. 31, Feb. '45, pp. 87-89.

Made of 16 gage cold rolled steel, each raft is separated into 19 airtight compartments, plus two airtight water tanks. Food and equipment are stored in four compartments near the center, and are reached through large openings in the side of the well deck. The openings are bolted closed by means of screws, which may be removed in a couple of minutes.

23-66. **Building the JMR Mars Flying Boat.** *Modern Machine Shop,* v. 17, March '45, pp. 124-130, 132.

A series of views in the plant of the Glenn L. Martin Co., showing some of the fixtures and tools.

23-67. **Developments in Light-Gage Steel Construction.** Milton Male. *Steel,* v. 116, March 19, '45, pp. 108-110, 146.

Systems fostered by exigencies of World War II feature speed and economy both in fabrication and erection on large-scale building operations.

23-68. **Steel Houses.** *Iron & Steel,* v. 18, Jan. '45, pp. 3-5.

Constructional details of a rapidly assembled permanent dwelling.

23-69. **Light Alloys for Marine Engines.** A. J. Murphy. Institute of Marine Engineering, *Transactions,* v. 57, part 2, 1945, Preprint, 12 pp. British Non-Ferrous Metals Research Association *Bulletin,* v. 25, Jan. '45, p. 4.

Presents characteristics of light alloys which designers will wish to take into account in development of marine engines. Pistons; cylinder heads; wrought light alloys; castings (tensile and fatigue properties); effects of stress concentration; internal stresses in castings.

23-70. **Aluminum: Now a New Metal.** *Modern Industry,* v. 9, March 15, '45, pp. 42-45.

Thirteen advantages; new alloys are stronger; going down; dual economies; quick shifts are a cinch.

23-71. **Unusual Problems Involving Leakage.** Max Walten. *Sheet Metal Worker,* v. 36, Feb. '45, pp. 37, 50.

Details of a copper deck mold and a gutter lining.

23-72. **Chromate Gasketing.** W. J. Montgomery. *Sheet Metal Worker,* v. 36, Feb. '45, pp. 41-42.

Ease of cutting, resistance to fire and water make the chromate gasket more than a substitute for war-scarce rubber gasketing.

23-73. **They Are Replaceable.** A. G. Pogmore. *Die Casting,* v. 3, March '45, pp. 23, 32-33.

Shows two examples of die casting applications common in filter industry.

23-74. **Clear Sighted Objectives Obtained.** D. Voorhies. *Die Casting,* v. 3, March '45, pp. 34-35, 41-42, 44-45.

To Navy men fogged binoculars are intolerable—but how to make such a moving mechanism moisture-proof has been an impossible production problem—until modern die cast parts were used. The lessons gained have application in many fields.

23-75. **Into the Alloy Age.** Fred P. Peters. *Scientific American,* v. 172, April '45, pp. 199-207.

Agonizingly slow was man's early development of the use of metals, but during the last 100 years, and especially the last 50 years, alloys have changed the whole picture of metallurgy. Progress has been breath-taking and today points the way to the unfolding of the alloy age.

23-76. **Metals in the Air.** *Scientific American,* v. 172, April '45, pp. 213-215.

Aviation's present achievements are based on the quantity production of strong, light weight metals. Of these, aluminum is most widely used because it combines the necessary qualities of toughness and lightness with low cost. But steel and magnesium are coming into wide use.

23-77. **Metals of the Future.** *Scientific American,* v. 172. April '45, pp. 216-218.

Chemical industry provides the base from which spring the marvels of metallurgy. Important to tomorrow's applications of metals is the developing knowledge of the rarer elements and their value in extending the usefulness of the more common metals in use today.

23-78. **Plastics Plus Metals.** *Scientific American,* v. 172, April '45, pp. 222-224.

Additional uses for both materials are supplied by skillful application of techniques now developing. Metal coatings for plastics take advantage of characteristics not found in either material alone. Metal inserts and assembly devices offer diversity to the designer.

23-79. **Aluminum and Magnesium in the Electrical Industries.** B. J. Brajnikoff. *Light Metals,* v. 8, Jan. '45, pp. 16-24.

Difficulties encountered in the clamping of steel-cored aluminum cable and the results of Russian research on this. 2 ref.

23-80. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, Jan. '45, pp. 25-41.

Theory, practice, and operation of the electrolytic condenser. In particular, the properties of the aluminum oxide film.

23-81. **Aluminum in the Chemical Industry.** *Light Metals,* v. 8, Jan. '45, pp. 42-50.

Applicability of aluminum for the construction of various items of apparatus for specific purposes in the fine and heavy chemical industries.

23-82. **Aluminum Hoisting Equipment.** A. G. Arend. *Aluminium and the Non-Ferrous Review,* v. 9, July-Sept. '44, pp. 42-43.

Advantages of light-weight sections; constructional methods involved; comparative weights.

23-83. **Light Alloys in Heavy Engineering.** *Light Metals,* v. 8, Feb. '45, pp. 53-69.

Realized applications of aluminum-base and magnesium-base alloys in the sphere of heavy engineering. Some indications as to lines of future development.

23-84. **New-Type Rolling Stock in Switzerland.** *Light Metals,* v. 8, Feb. '45, pp. 70-78.

Recapitulation of pre-war developments of some of the newer applications of light metals in Swiss rolling stock.

23-85. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, Feb. '45, pp. 87-100.

Theory and practice of the formulation of electrolytes for electrolytic condensers, and the design and production of such condensers, typical examples and applications.

23-86. **Wrought Aluminum Alloys for Aircraft.** Don A. Lawless. *Aluminum and Magnesium,* v. 1, Jan. '45, pp. 12-15.

Review of certain developments to date. Its main purpose is not necessarily to predict which of the new developments will eventually prove the most satisfactory for general use. Increasing the strength of 24S; "UT" temper. New alloys: modified dural type; zinc-magnesium type; free machining type. Aircraft engineering factors. 3 ref.

23-87. **Manganese Bronze Propellers.** *Foundry,* v. 73, April '45, pp. 108-109, 228, 230.

Manganese bronze for propellers conforms to the following specifications: Copper 58%; zinc 39%; iron, aluminum and manganese 1% each. This metal shows tensile strength 70,000 psi., and 35% elongation.

23-88. **Notes About Some Steel Cartridge Cases Made in Germany.** *Metal Progress,* v. 47, March '45, pp. 491-496.

German cartridge cases made of steel used by the enemy, and studied by American metallurgists. Composite cases for larger calibers; 50-mm. tank-gun ammunition; 20-mm. steel cases; one-piece cases for larger calibers.

23-89. **Effect of Cemented Carbides on Product Design.** Harry Crump and Paul Miller. *Product Engineering,* v. 16, April '45, pp. 217-221.

Presenting with examples the many possibilities in the use of cemented carbides for improving product design by increasing the life of parts. Physical properties and methods of attaching carbide parts to base materials are outlined.

23-90. **Design of Hydraulic Systems, IV.** Howard Field. *Product Engineering,* v. 16, April '45, pp. 265-269.

Selector and relief valves analyzed as to their design, characteristics, uses and construction. Valves classified as to type and sketches used to illustrate the design and operating features. Problems of materials used and internal leakage discussed in detail.

23-91. **Metals in Housing.** *Metal Industry,* v. 66, March 23, '45, pp. 183-185.

Value from the architect's and craftsman's standpoint.

23-92. **Use of Light Metals in Transportation.** C. D. Young. *Aluminum and Magnesium,* v. 1, March '45, pp. 17, 22-23, 26-27.

Future use of aluminum and magnesium in transportation equipment, as against ferrous metals, will be determined largely by the relative price positions of the two groups of metals and the development of the art in structural design as it involves the use of the alloys of steel, aluminum and magnesium. Reviews briefly the uses prior to the war. Table shows use of aluminum by highway, railway, and water transportation in 1939.

23-93. **Fiberglas Insulation for Wire and Cable.** Roy J. Black. *Wire and Wire Products,* v. 20, April '45, pp. 278-282.

Aid in production of Fiberglas covered wire.

23-94. **How Rail Failures Are Being Prevented.** R. E. Cramer. *Metal Progress,* v. 47, March '45, pp. 521-524.

Appraisal of the rail investigation at Urbana. Control-cooling has solved the major portion of rail failures which occurred during the first five years of their service. New types of failures such as shelly rail failures are still being investigated. It is believed that considerable change in rail properties will be necessary to avoid them.

23-95. **Detection and Prevention of Incipient Cracking in Firebox and Boiler Steel.** Ray McBrian. *Metal Progress,* v. 47, March '45, pp. 524-527.

Most prolific cause of trouble in locomotive boilers and fireboxes.

23-96. **Metal Limitations in the Perfection of Motive Power.** Paul L. Irwin. *Metal Progress,* v. 47, March '45, pp. 527-529.

Metal limitations in the perfection of motive power can be eliminated by: Striving to bring the quality of steel billets and plates up to prewar level or better; continuing the use of magnetic, radiographic, fatigue and electronic testing; improving the control of processing and of the actual heat treatment; utilizing any of the new metallurgical and process developments that will be sufficiently beneficial to the part under consideration.

23-97. **Improving the Railroad Axle.** O. J. Horger. *Metal Progress,* v. 47, March '45, pp. 529-532.

Axles and crank pins may be improved by proper shape but to obtain the maximum fatigue resistance, residual compressive stresses must also be present in the surface layers. Compressive stresses may be obtained by thermal means or by some form of cold work or rolling.

23-98. **The Railroad Car Journal Bearing.** John R. Jackson. *Metal Progress,* v. 47, March '45, pp. 532-534.

Journal bearings under cars in interchange service.

23-99. **Some Effects of the Trend Toward Rolling Stock of Lighter Weight.** Stephen H. Badgett. *Metal Progress,* v. 47, March '45, pp. 534-536.

Body design; relative costs; economics.

23-100. **Naval Construction.** H. F. James. *Metal Industry,* v. 66, March 16, '45, p. 162.

The possibilities for the increased use of light alloys.

23-101. **The Production of Hollow-Steel Aircraft Propeller Blades.** *Machinery* (London), v. 66, March 29, '45, pp. 341-344.

Welding, forging, brazing, and forming operations.

23-102. **Induction Heating at Chevrolet's Saginaw Plant.** *Modern Industrial Press,* v. 7, April '45, pp. 34-35.

Application of induction heating to the task of heating propeller blade hubs preparatory to the installation of a thrust bearing, and the subsequent upsetting operation.

23-103. **Die-Cast Products Can Recast Costs.** *Modern Industry,* v. 9, April 15, '45, pp. 45-47, 151-152.

Big parts, little parts, large lots, or small—there's almost no limit to the jobs die casting can do. It's ready to help find wider markets by turning out higher quality products at bargain prices.

23-104. **Metallurgical Aspects of Machine-Tool Castings.** J. G. Ritchie. *Foundry Trade Journal,* v. 75, March 29, '45, pp. 251-255.

Specifications and testing; improved wear resistance; hardening and tempering; stress relieving. 49 ref.

23-105. **Development of the Freight-Car Truck.** R. B. Cottrell. *Railway Age,* v. 118, May 5, '45, pp. 790-791, 793.

Sound design must be accompanied by effective structural and performance testing—conclusions drawn from such high-speed service tests as have been made.

23-106. **Cables and Wire for Military Aircraft.** *Wire & Wire Products,* v. 20, May '45, pp. 337-338.

Aircraft cables and wires are made of carbon steel and stainless steel and must conform to rigid specifications. Size of cables used for aircraft controls ranges from 1/16 to ¼ in. in diameter and the strands vary from 7 wires to a strand to 19 wires.

23-107. **Postwar Pistons.** Joseph Geschelin. *Automotive Industries,* v. 92, May 1, '45, pp. 33, 38.

What can the engine designer expect in pistons for postwar use? Survey among the leading producers of pistons leads to the conclusion that postwar progress is bound to be striking and will stem from experience gained from war production.

23-108. **Maintaining Quality of Small Arms Ammunition.** M. R. Wilson. *Canadian Metals & Metallurgical Industries,* v. 8, April '45, pp. 37-40.

System of quality control which would isolate any factor that might cause an excessive amount of process scrap or rejected cartridge lots. All raw materials accepted into the plant to be used for processing were held to specifications which would not cause defects at processing; secondly, it was necessary to maintain quality of each processing operation at a satisfactory level, and thirdly, provide accurate records of all rejects found.

23-109. **Aluminum and Magnesium Alloys in Light Engineering.** *Light Metals,* v. 8, April '45, pp. 155-168.

Applications of light metals for a wide variety of smaller structures where low deadweight is of primary importance.

23-110. **Method for Field Lining Vessel Heads with Stainless Steel Strip.** K. E. Luger. *Oil & Gas Journal,* v. 44, May 12, '45, pp. 92-94.

Method described for protecting refinery-vessel heads against corrosion has the virtue of economy and simplicity, requiring no elaborate detailing in the drafting room. Expense of shop fabrication may be eliminated, and field fitup time lowered because the small pieces allow flexibility. Waste from scrap is negligible.

23-111. **Increased Use of Gray Cast Iron in High Temperature Operations.** C. O. Burgess and T. E. Barlow. *American Foundryman,* v. 7, May '45, pp. 57-65.

Survey of the behavior of cast iron in elevated temperature applications. Detailed information on 233 commercial applications of cast iron at temperatures over 450° F. was obtained from 99 concerns and 108 individuals. Data show that within a temperature range of 450 to 1000° F., cast irons of controlled analysis can be successfully employed in numerous engineering applications. Included in these applications are castings which must resist pressure and be free from small dimensional changes.

23-112. **The Snow Cruiser.** *Modern Metals,* v. 1, May '45, pp. 4-5.

Cab is an all-aluminum structure, and the manufacturers are looking forward to using aluminum in greater quantities after they have an opportunity to redesign the cruiser.

23-113. **Magnesium Air Ducts.** L. T. Holtzman. *Modern Metals,* v. 1, May '45, pp. 6-7

Development for wrought magnesium, which was considered infeasible at the outbreak of war. Aircraft manufacturers anxious and willing to consider many new components in magnesium for future aircraft.

23-114. **Aluminum Life Boats.** *Modern Metals,* v. 1, May '45, pp. 10-11.

Saving in weight, increased capacity, lower maintenance cost and longer life, are some factors which will contribute to large-scale application of aluminum in the boat industry. The rapidly expanding future is readily obvious in this article.

23-115. **Aluminum Windows.** *Modern Metals,* v. 1, May '45, pp. 16-17.

Market for aluminum windows after the war looms up large. New knowledge of forming, improved production methods and lower cost raw material will allow aluminum to compete with other products. New homes and buildings will be the main market, but in addition there is a large replacement potential for steel windows which had to go unpainted during the past four years.

23-116. **Light Alloy Pistons.** C. F. Russell and E. B. Graham. Institution of Automobile Engineers *Journal,* v. 13, April '45, pp. 131-165.

General review of light alloy piston development with particular reference to design, materials, manufacturing technique, and performance.

23-117. **High-Speed Passenger-Car Trucks.** K. F. Nystrom. *Mechanical Engineering,* v. 67, May '45, pp. 313-318.

Studies and developments in design and construction.

23-118. **Physical Properties of Automotive Bolts.** E. O. Mann. *Fasteners,* v. 2, no. 1, pp. 4-6.

The need for properly designed fasteners is critical in many automotive applications. Specifications should adhere to final physical properties rather than to chemical analysis or methods of manufacture.

23-119. **Gray Iron Castings for Power Plant Equipment.** Pat Dwyer. *Foundry,* v. 73, May '45, pp. 108-111, 210, 212, 214.

Description of plant.

23-120. **Producing Hollow-Steel Aircraft Propeller Blades.** *Machinery* (London), v. 66, March 22, '45, pp. 305-310.

Light weight blades with superior resistance against

erosion; because of their greater strength they are less easily damaged, not only in combat, but also in take-off and landing. Describes the interesting features of some welding and forming operations.

23-121. **Research Brings Better Railroading.** *Railway Age*, v. 118, May 5, '45, pp. 794-796, 798.

Back of the Norfolk & Western's transportation record are years of steady and progressive development based on laboratory and field studies. Batteries; abrasive testing machine; how to prevent rail shelling; cold rolling; better journal bearings; engine springs.

23-122. **Aluminum for Locomotives.** *Modern Metals*, v. 1, May '45, p. 9.

New York Central's new 6,000 h.p. locomotive, the Niagara, is constructed of over 3 tons of aluminum, reduces dead weight.

23-123. **Industrial Brushes.** L. E. Browne. *Steel*, v. 116, May 21, '45, pp. 106-108, 142.

Improvements in design and manufacture have resulted in increasing applications for cleaning metals and materials.

23-124. **Gear Teeth.** *Automobile Engineer*, v. 35, April '45, p. 151.

Special forms for use with high ratios.

23-125. **Testing Wire Wrapped Steel Pipe.** S. R. Beitler. *Iron Age*, v. 155, May 24, '45, pp. 58-61, 128.

Wire wrapping has been used to strengthen pipe. Tests under OPRD guidance were made to determine whether this practice could be advantageously applied to steel pipe intended for pipeline use. These tests, conducted on 120-ft. lengths of 24-in. diameter steel pipe, included field tests to discover its reactions to handling and pressure tests. Procedures used in winding the wire and the various tests and their results.

23-126. **Electrical Contacts, Part 1.** C. B. Gwyn. *Metals and Alloys*, v. 21, May '45, pp. 1318-1323.

Electrical contacts are among the most important types of special metal parts. Present development—trends and future probabilities in electrical contact materials.

23-127. **Glass as an Industrial Material.** *Metals & Alloys*, v. 21, May '45, pp. 1359, 1361.

Gives type, preparation, composition, sizes, etc., uses of sheet glass, laminated glass, formed glassware, glass fiber materials, and glass structural forms.

23-128. **Al and Mg for Sports Goods.** *Aluminum & Magnesium*, v. 1, May '45, pp. 24-25, 33.

Survey to determine the potential uses to which aluminum and magnesium could be put in sports goods items.

23-129. **Manufacturing the Hercules Piston, I.** J. A. Oates. *Aircraft Production*, v. 7, March '45, pp. 128-139.

Design details; press-forging methods employed by Specialloid, Ltd.; machining sequence; milling the pockets.

23-130. **Platinum Metals.** E. Rhodes. *Metal Industry,* v. 66, May 18, '45, pp. 312-314.

Detailed examples of the uses of the heavy metals in industry, such as contacts, plugs, furnace windings and for pyrometry.

23-131. **The Rare Metals Go to Work and to War, II.** H. A. Bolz. *Modern Machine Shop,* v. 18, June '45, pp. 140, 142, 144, 146, 148, 150, 152.

Platinum metals; vanadium, columbium and tantalum; selenium and tellurium; molybdenum and tungsten; germanium and rhenium.

23-132. **Better Piston Rings From Wartime Experience.** Joseph Geschelin. *Automotive Industries,* v. 92, June 1, '45, pp. 32, 94, 96, 100.

Progressive improvement comes from advancements in metallurgy, surface treatments, surface finish, machine shop practice and quality control.

23-133. **New Packing Resists Corrosion and Heat.** *Iron Age,* v. 155, June 7, '45, p. 68.

Flexible metallic packing capable of withstanding temperatures up to 2000° F. and highly resistant to corrosive gases, alkalies and most acids.

23-134. **Die Castings in the Automobile Industry.** *Die Casting,* v. 3, May '45, pp. 22-24.

Covers the applications of die castings in different industries. The advantages peculiar to the industry are discussed, together with indications of the future trends in design and engineering.

23-135. **Design for a Better Sander.** Peter Zasadny. *Die Casting,* v. 3, May '45, pp. 26-28, 36-40.

Consumer acceptance, performance records, and exceptionally low percentage of service complaints have fully proved the soundness of this die cast design.

23-136. **Procedure for Application of Stainless - Steel Strip Liners to Refinery Vessels in the Field.** K. E. Luger. *Petroleum Refiner,* v. 24, May '45, pp. 99-102.

Detailed description covering satisfactory procedure for attaching strip liners.

23-137. **Ceramic Linings for Acid Tanks.** *Petroleum Refiner,* v. 24, May '45, p. 120.

Tank consists of an outer shell of steel or concrete which is protected on the inside by a lead sheathing or an impervious acid-resisting plastic coating, and an inner lining of acid-proof brick.

23-138. **Aluminum and Magnesium in the Electrical Industries.** B. J. Brajnikoff. *Light Metals,* v. 8, May '45, pp. 205-211.

Deals with the mechanical properties, more especially in the heated state, of aluminum in relationship to its use as a conductor.

23-139. **Aluminum and Magnesium Alloys in Light Engineering.** *Light Metals,* v. 8, May '45, pp. 215-221.

Survey of the use of aluminum and magnesium alloys in the construction of smaller machine tools and allied equipment. In some instances, the applications are of a highly specific nature.

23-140. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, May '45, pp. 246-254.

Concludes discussion on wet and dry electrolytic condensers and detailed consideration of fixed paper condensers.

23-141. **Manufacture of the All-Steel Refrigerator Cabinet.** C. A. Traphagen. *Steel Processing,* v. 31, May '45, pp. 289-293, 301.

Description of manufacture of the all-steel fabricated product.

23-142. **Corundum—A Vital Wartime Abrasive.** Roland D. Parks. *Mining Technology,* v. 9, May '45, T.P. 1883.

Description of the corundum industry, the administration of wartime control, and certain economic aspects. 7 ref.

23-143. **"Mousetrap" Firing Device.** *Steel,* v. 116, June 11, '45, pp. 126-127.

Made from stampings and assembled in special jigs.

23-144. **High-Head Turbine.** *Steel,* v. 116, June 11, '45, pp. 150, 194.

New turbine is vertical-shaft type designed to supply 39,000 horsepower under head of 1028 ft., highest for its kind in western hemisphere.

23-145. **High Strength Steels Pace Lightweight Development.** F. D. Foote. *Iron Age,* v. 155, June 14, '45, pp. 61-65, 124, 126, 128, 130, 134, 138, 140, 142, 144, 146, 148.

Because of the inherent corrosion resistance of the low alloy high strength steels even greater weight saving can be obtained on mobile structures where corrosion is a controlling factor in determining thickness of plate than strength considerations alone would dictate. Evaluates these steels from their relative technical and economic advantages for the construction of railroad rolling stock, mine and dump cars, trucks and trailers, and barges.

23-146. **The Automobile You Should Get.** *Modern Metals,* v. 1, June '45, pp. 4-7.

Much has been learned about power-driven conveyances during this war. Many of the techniques and designs can be applied advantageously to future conventional automobiles. Resume of ideas.

23-147. **Platinum Metals.** E. Rhodes. *Metal Industry,* v. 66, May 11, '45, pp. 290-292.

Use of platinized asbestos as a catalyst for converting sulphur dioxide to trioxide in the Contact process well known, but further uses of platinum and of the other metals in the group are, perhaps, not so well known. Illustrates some of these uses.

23-148. **These Connection Techniques Solve Aluminum Cable Problems.** Julian Rogoff. *Aviation,* v. 44, June '45, pp. 134-137, 271-272.

Obstacles encountered in effecting dependable, low-resistance hookups with aluminum cable, and how surface treatment of aluminum connectors and proper installation practice can overcome these difficulties.

23-149. **Platinum Metals.** E. Rhodes. *Metal Industry,* v. 66, May 25, '45, pp. 327-329.

Spinnerets for viscose, plating, jewelry, dentistry, and prospects for further commercial applications of this group.

23-150. **Die Castings in the Automotive Industry II.** *Die Casting,* v. 3, June '45, pp. 24-27, 56-57.

Use for decoration.

23-151. **One Good Turn Deserves Another.** L. F. Mead. *Die Casting,* v. 3, June '45, pp. 28-29.

Die cast construction chosen for design of a modern can opening device.

23-152. **The Development of Tin-Free Cans.** H. Kettere. *Metall Wirtschaft,* v. 22, Oct. 20, '43, pp. 493-498.

23-153. **Improved Processes Widen Scope of Ferrous Castings.** G. Vennerholm. *Machine Design,* v. 17, June '45, pp. 135-138.

Discusses improvements of the last few years which will influence the future of the casting for engineering purposes. If certain fundamental principles are followed when designing parts to be cast, some of the difficulties in obtaining sound castings can be eliminated. Greatest change has taken place in the steel foundries.

23-154. **Bug Bombs.** *Steel,* v. 116, June 25, '45, pp. 118-119, 156, 160.

Production of small but mighty "bombs" used to spray insecticides requires some unusual techniques to insure both light weight and resistance to high pressures. Peacetime market being studied.

23-155. **Sheet Lead on State Capitol Dome.** *Sheet Metal Worker,* v. 36, June '45, pp. 47-49.

Application of lead to Pennsylvania Capitol dome typical of proper installation practice for sheet lead work.

23-156. **Air Supported Roof of Aluminum.** Herbert H. Stevens, Jr. *Aluminum and Magnesium,* v. 1, June '45, pp. 25, 41.

New methods of construction using air pressure in place of beams and columns to support the roof of large buildings promises a new and tremendous outlet for the use of aluminum.

23-157. **Chilled Tread Wheels for Freight Cars.** William E. Turner. *Pig Iron Rough Notes,* no. 99, Spring-Summer, '45, pp. 10-16.

Standard sizes; chemical composition; specified weights; production and standards.

23-158. **Light Metals in Fire-Fighting Equipment.** *Light Metals,* v. 8, June '45, pp. 271-277.

Theory and practice of applications of light and ultra-light alloys in the construction of fire escapes, pumps and miscellaneous equipment.

23-159. **Aluminum and Magnesium in the Electrical Industries.** *Light Metals,* v. 8, June '45, pp. 278-287.

Light alloys in electro-technology. Russian work on soldered joints in aluminum reviewed. 6 ref.

23-160. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, June '45, pp. 292-304.
Detailed survey of fixed paper condensers. A comparative study presented of the uses of tin foils in various forms, and of aluminum foils.

23-161. **Aluminum—During the War and After.** P. V. Faragher. *Iron & Steel Engineer,* v. 22, June '45, pp. 76-79.
Aluminum, with capacity built up by war demands and with broadened knowledge and experience, looks to postwar applications with optimism.

23-162. **Blackheart Malleable Iron Castings Used on New Sydney Graving Dock.** *Metallurgia,* v. 32, May '45, pp. 7-8.
Where strength, ductility, machinability and resistance to shock are important considerations, malleable iron castings find a wide field of industrial applications. Production methods developed in recent years have greatly increased the size of malleable castings as is indicated by the description of the application of Blackheart malleable cast iron to the production of large and heavy castings.

23-163. **Some Applications of Welded Aircraft Tubing.** J. S. Adelson and Park Hill. *Sheet Metal Industries,* v. 21, June '45, pp. 1064-1066.
Deals with alloy 4130 and 8630 tubing for motor mounts, low carbon tubing for intake tubes and stainless tubing for exhaust stacks; engine mounts; aircraft intake tubes; aircraft exhaust header; sizing and facing operations.

23-164. **The Battleship's Nerve System.** H. A. Cowan. *Die Casting,* v. 3, July '45, pp. 22-24, 39-40.
In the redesign of this equipment with die casting no less than 46 piece parts were eliminated. On the manufacture of 2000 units it was possible to liquidate the cost of tools and in addition show a savings of 20%. Direct labor and material costs showed a decrease of 70% and 23% respectively.

23-165. **Styling the G-Suit.** Raymond Fenner. *Die Casting,* v. 3, July '45, pp. 26-28, 38-39.
A flying suit known as the "G-Suit" has been developed which utilizes an ingeniously designed valve constructed of die castings.

23-166. **Die Castings Meet Competition in the Electrical Home Appliance Field.** *Die Casting,* v. 3, July '45, pp. 30, 32-34, 36-38.
Home appliance manufacturers are among the largest users of die castings. This production method has been selected for its obvious advantages of low unit costs, uniformity of parts, minimum machining, ease of part finishing. Die castings will be used even more extensively in the postwar appliances now being designed.

23-167. **Industry's Permanent Pull.** Fred P. Peters. *Scientific American,* v. 173, July '45, pp. 36, 38-39, 49.

Modern permanent magnetic alloys, two to ten times more powerful than former materials, are responsible for compact, efficient wartime energy-converting devices and will be the key elements in many post-war electrical and electronic products.

23-168. **Bridges of Aluminum.** *Modern Metals,* v. 1, July '45, pp. 4-5.

"Behind-the-scene" problems and how they were handled by a manufacturer of the Army's M-4 aluminum bridge.

23-169. **Light Metals and Personal Flying.** Frederick H. Roever. *Modern Metals,* v. 1, July '45, pp. 10-12.

Points out that light metals have distinct appeal and gives factors which will contribute to this new industry.

23-170. **Opportunities for Magnesium in the Petroleum Industry.** *Modern Metals,* v. 1, July '45, p. 13.

Petroleum industry offers several good applications for magnesium products. Listed are a few of these possibilities.

23-171. **Light Metal Seating.** *Modern Metals,* v. 1, July '45, pp. 14-15.

Variety of seats, constructed primarily of aluminum and magnesium products, may set the pace for postwar seating in homes and offices. Not only because they are light in weight, but also because they were designed for prolonged comfort and to permit adjustability.

23-172. **Wire Sound Recorder.** *Modern Metals,* v. 1, July '45, pp. 16-17.

Magnetic wire sound recorder. Application for light metals because its main use may be in a small unit, capable of being easily carried around.

23-173. **Magnesium Griddles.** *Modern Metals,* v. 1, July '45, p. 19.

Greasing is unnecessary; they heat up evenly and rapidly and are very light. It might be a logical product for organizations seeking new postwar markets.

23-174. **NE Steels for Bearings and Bolts in Farm Equipment.** J. H. Clark, J. D. Walker and A. S. Jameson. *Metal Progress,* v. 48, July '45, pp. 97-104.

Describes a few specific parts which are of interest to metallurgists generally. Article confines itself to the steels used in roller bearings and bolts.

23-175. **Technics of Tins.** R. T. Colgate. Society of Chemical Industry *Journal,* v. 64, June 16, '45, pp. 186-188.

Scientific application to purchase and maintenance of biscuit tins; relation of manufacture of strip steel to tin plate industry; spectacular advances in electrotinning of strip steel in America.

23-176. **Post-War Finishes for Light Metal Transportation Equipment.** Louise C. Mann. *American Paint Journal,* v. 29, July 9, '45, pp. 43, 46-47, 50.

Structural use of light metals in the post-war era. To what extent will they be used by the railroads? Whether economies in operating cost are sufficient to make up for the higher original cost.

23-177. **Many Special Machines Help Produce Tapered Roller Bearings at Timken.** G. W. Birdsall. *Steel,* v. 117, July 9, '45, pp. 106-110, 112, 164, 166, 168, 170, 172.

Bearing rollers are automatically gaged and grouped for selective fits; outer and inner races gaged by operators on special setups. Unique design, engineering and production features result in a precision famed wherever wheels and shafts must turn easily.

23-178. **Self-Aligning Fastener.** *Steel,* v. 117, July 9, '45, p. 116.

Lightweight, easily and quickly inserted, and can be nested to handle heavy loads.

23-179. **Threads of Stainless Steel.** *Vancoram Review,* v. 4, Spring '45, p. 9.

Provide the ideal non-absorbable surgical suture.

23-180. **Aluminum Qualifies for Postwar Uses.** P. B. Jackson. *SAE Journal,* v. 53, July '45, p. 32.

Available supply of aluminum and its price are important factors influencing its usefulness in postwar markets. They have many characteristics—intrinsic and basic—which individually or collectively produce better products than other available materials.

23-181. **"Battle Tough" Armor Plate at Ford Motor Co.** P. D. Aird. *Modern Industrial Press,* v. 7, June '45, pp. 13-15, 24, 30.

Constant tests of stock insure the quality of toughness, for in addition to the conventional tests for hardness which are applied to every sheet of armor plate that emerges from the press-quenching operation, firing tests are required on every heat. Part of the success due to the heat treating and quenching process. By this method Ford engineers have reduced to two or three minutes process which previously sometimes required hours.

23-182. **Fabricating of the 155 Mm Howitzer at Yuba Manufacturing Company.** Gerald E. Stedman. *Modern Industrial Press,* v. 7, June '45, pp. 18-20, 36.

Details the many improvements in practice that have been developed by Yuba engineers, tool designers and shopmen in the gradual establishment of the present high order of production efficiency. 31 specific changes that have each played their part in man hour reduction.

23-183. **Naval Ordnance Plant Builds 5-In. Guns.** *American Machinist,* v. 89, July 19, '45, pp. 122-127.

Westinghouse-operated war-built plant holds limits of ten thousandths of an inch on gun assemblies weighing many tons.

23-184. **NE Steels for Steering Knuckles and Axle Drive Shafts.** J. H. Clark, J. D. Walker and A. S. Jameson. *Metal Progress,* v. 48, Aug. '45, pp. 280-287.

Object of test procedures was to obtain step-by-step information which would allow use of new steels, economical in alloys, during emergency when alloying metals were scarce, and at same time produce parts which would be capable of satisfactory performance under normal service conditions. From field reports there has been no reason to suppose that where the NE steels have been used they have not given service comparable with original steels they replaced.

23-185. **Coil-Shank Bolts and Nuts.** *Engineering,* v. 159, June 29, '45, p. 516.

Combination of the properties of a helical spring in tension with the compressive properties of the ordinary screwed nut; it is not intended to replace the ordinary solid bolt in situations where heavy loading is desired, but is designed for securing accessory attachments, light structures, mechanisms requiring shock-absorbing properties.

23-186. **Four Types of German Aircraft Engine Radiators.** M. W. Bourdon. *Automotive Industries,* v. 93, July 15, '45, pp. 32-34, 110, 112, 114.

Report issued by the British Ministry of Aircraft Production dealing with design, construction and materials of four types of radiator removed from German aircraft.

23-187. **Light Alloys in Photocells, Rectifiers and Condensers.** *Light Metals,* v. 8, July '45, pp. 348-359.

Properties of interleaving papers are critical, and, physically and chemically, are related to the electrode metals.

23-188. **Light Alloy Bicycles.** *Light Metals,* v. 8, July '45, pp. 360-362.

Early history of the aluminum alloy bicycle, together with a discussion on the theory and practice of more recently developed models.

23-189. **Enameled Steel Segments.** *Steel,* v. 117, July 23, '45, p. 120.

Developed from airport markets and commercial signs.

23-190. **Aluminum Foil on Postwar Production Lines.** *Modern Packaging,* v. 18, July '45, pp. 100-102, 174, 176.

Foil-wax-paper laminations; sterilized bandage wrap; foil tight wraps; gravure printed foil in rolls; foil laminations for unit packs; plain foil uses; cathodic protection with foil; foil for butter wrappers.

23-191. **Production of Light Weight Blast Furnace Slag.** H. O. Wicks. *Iron & Steel Engineer,* v. 22, July '45, pp. 71-76.

Using a continuous machine process of dry granulation which offers control of moisture content and of cell structure, blast furnace slag is converted into a semigranular cellular material having great possibilities in the building field.

23-192. **Ball Bearing Versatility.** H. F. Williams. *Machine Tool Blue Book,* v. 41, Aug. '45, pp. 199-200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222.

Interesting and novel uses of these "Jewels of Industry."

23-193. **New Uses of Aluminum Will Aid Postwar World.** *Western Metals,* v. 3, July '45, pp. 20-21.

Uses in transportation, farm or city building; helping spin nylons and ready-mixed paints.

23-194. **Wire Gold Braid and Military Insignia.** R. Levi. *Wire & Wire Products,* v. 20, Aug. '45, pp. 559-562.

Describes development of new industry and different manufacturing processes.

23-195. **High Strength Steels for Light Weight Structures.** Frederick D. Foote. *Metals & Alloys,* v. 22, July '45, pp. 92-99.

Low alloy high strength steels containing enough "alloy" to provide superior yield strength and corrosion resistance as compared to structural carbon steels are expected to play a prominent part in the design and construction of light weight transportation equipment to be built and used in the postwar period. Discusses these steels from the engineering point of view with special attention to their mechanical properties, corrosion resistance and general suitability for light weight design.

23-196. **Aluminum in the Chemical Industry.** J. L. Bray. *Aluminum & Magnesium,* v. 1, July '45, pp. 14-17, 25, 28-29.

Aluminum and its alloys have found wide application in the manufacture and handling of textiles, paper, rubber, petroleum, paint, organic and inorganic chemicals, food, soap and explosives. Characteristics which make aluminum such a useful metal to these industries are: Chemical stability; high heat conductivity; ease of fabrication; light weight; available form.

23-197. **"Tool Steel Tubing" Used in Construction of Dies for Manufacture of Practice Mines.** Sanford Markey. *Modern Industrial Press,* v. 7, July '45, pp. 28, 30.

Advantages multiplied to the point where the material can be best used in three main divisions. These are: Cutting, blanking and forming tools; sleeves, bushings, collets, reciprocating parts; machine parts, such as bearings and rolls.

23-198. **The A.I.R.O.H. House.** *Metal Industry,* v. 67, July 20, '45, pp. 38-39.

Constructional details, assembly methods and internal fittings of aluminum houses.

23-199. **Aluminum Alloy Pistons.** *Metal Industry,* v. 67, July 20, '45, p. 41.

Importance of metallurgical control in fabrication; wrought and cast pistons.

23-200. **Mir-O-Col Alloy Development.** Robert E. Turman and W. Wesley Mills. *Western Machinery & Steel World,* v. 36, July '45, pp. 308-310.

New uses for Ni-Resist and hard-facing metals in post-war era create demand for enlarged facilities.

23-201. **Methods of Manufacturing Magnesium Spoilers.** *Western Machinery & Steel World,* v. 36, July '45, pp. 318-319, 321.

Embraces the design, fabrication and heliarc welding of the magnesium spoiler used in the Black Widow P-61 night fighter.

23-202. **Making Torsion-Bar Springs.** Charles O. Herb. *Machinery,* v. 51, Aug. '45, pp. 141-149.

Springs in the form of straight bars have proved advantageous on military vehicles and may find post-war applications. Describes the procedure of the Spencer Mfg. Co.

23-203. **Manufacture of Consumer Gas Ranges.** Fred Doering. *Steel Processing,* v. 31, July '45, pp. 434-437.

Cooking range development, manufacture, promotion and sale has graduated and matured. Increasingly important is the total research required to provide the customer with a scientifically designed precision cooking instrument.

23-204. **Applications and Advantages of Constructional Alloy Steels.** *Steel Processing,* v. 31, July '45, pp. 442-445.

Selection and application of a steel depends upon formability, machinability, welding properties, size of section, hardenability, creep strength, toughness, resistance to wear, fatigue strength, and low temperature performance. Steels enumerated for use in gears and shafts, springs, oil industry equipment, and aircraft.

23-205. **A Roof That Floats on Air.** *Sheet Metal Worker,* v. 36, July '45, pp. 41-42.

Plans proposed for a stadium having a 900-ft. diameter aluminum roof which is blown up like a ballon and supported with ventilating fans.

23-206. **War Alloy Steels Shoot the Works.** D. B. Stough, *Stove Builder,* v. 10, Aug. '45, pp. 25-28, 74, 76.

Plant expansion needed; increase in alloy steels; prewar and war uses; alloying elements; war peak passed; stainless steels; use in industrial fields.

23-207. **Aluminum Lightning Rods.** *Modern Metals,* v. 1, Aug. '45, p. 7.

A 12-in. aluminum air terminal complete with roof saddle or support. The saddle is attached to the pure aluminum lightning rod; early history; fabrication now easier; aluminum vs. copper; lightning.

23-208. **Laminated Aluminum Solves Protection Problems.** John M. Cowan. *Modern Metals,* v. 1, Aug. '45, p. 13.

Outline of a new material which protects heavier materials and supplies better than will aluminum foil. This laminated foil and cotton material probably has a future for packing radios, typewriters and heavier materials to be shipped to distant markets.

23-209. **Aluminum Bridges—A Gateway to Further Structural Applications.** *Modern Metals,* v. 1, Aug. '45, pp. 18-19.

Versatility of the battle-tested metal—aluminum—gives promise to many new applications for this metal, visualizes a virtual boom for aluminum in such applications as boats, river barges, elevators, refrigerated automobiles, boxcars and many others.

23-210. **Plumbing Fixtures.** W. C. Nichols and Joseph Palma, Jr. *Die Casting,* v. 3, Aug. '45, pp. 26-27, 58.

Projected designs for plumbing fixtures are presented, based on the use of zinc and brass alloys.

23-211. **Die Casting in Canada.** *Die Casting,* v. 3, Aug. '45, pp. 28, 30-33.

Extensive application of die castings in Canada's war production program similar to this country. However, there have been some ordnance designs shown which are quite different from American practice.

23-212. **Precision Instrument Assemblies.** Ralph Bazley. *Die Casting,* v. 3, Aug. '45, pp. 34, 36-38.

Investment required for dies can be fully justified in die castings by the accrued savings in machining, through dimensional uniformity, which simplifies or eliminates subsequent tooling.

23-213. **Case Studies of Die Casting Applications.** *Die Casting,* v. 3, Aug. '45, pp. 52-56.

Illustrates, by concrete examples, why experienced designers chose die castings for certain products.

23-214. **Improved Techniques Produce Superior Stainless Clad Steel.** L. W. Townsend. *Steel,* v. 117, Aug. 20, '45, pp. 145, 148, 150.

Postwar opportunities for use of stainless clad metal may increase in proportion to growing importance of cladding. Applications range from heavy stainless clad for chemical equipment to sheets as thin as 0.025 in. gage.

23-215. **Ball and Roller Bearing Steels.** Hudson T. Morton and Earl E. Wagner. *Steel,* v. 117, Aug. 27, '45, pp. 100-102, 144, 146.

Over the years, many different steels have been tried for ball and roller bearings, but carbon-chromium and nickel-chromium-molybdenum grades remain standbys. NE 52100 given preference for certain applications. 3 ref.

23-216. **Analysis of Magnesium Applications in German Aircraft and Equipment.** F. A. Rappeleyea. *Aviation,* v. 44, Aug. '45, pp. 144-148.

Study of new uses of forgings, sand and die castings in BMW-801D and DB-601E engines, and Fungerrat radio reveals Nazis used alloys similar to ours; their techniques showed no superiority. 8 ref.

23-217. **Automotive Bolts.** A. S. Jameson. *Iron Age,* v. 156, Aug. 30, '45, pp. 47-49.

Use of alloy steels for automotive bolts. The chief advantage of alloy steel for this purpose lies in its hardenability, since there appears to be no difference in the ductility factor.

23-218. **Low Melting Alloys as Production Aids.** Walter C. Smith. *Metals & Alloys,* v. 22, Aug. '45, pp. 397-402.

Characteristics of the ultra low melting bismuth alloys, and their applications for anchoring dies, tube bending, proof casting, electroforming, fixture work, precision casting and other processes.

23-219. **Light-Alloy Bicycles.** *Light Metals,* v. 8, Aug. '45, pp. 365-375.

Account of the development and present status of the aluminum bicycle.

23-220. **A Car for Better Days.** *Light Metals,* v. 8, Aug. '45, pp. 378-380.

Part to be played by light alloys in the car of the future.

23-221. **Aluminum and Magnesium in the Electrical Industries.** *Light Metals,* v. 8, Aug. '45, pp. 384-401.

Consideration of the theory and practice of the use of aluminum insulated by anodic treatment for electrical windings. 19 ref.

23-222. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, Aug. '45, pp. 409-414.

Problems involved in condenser manufacture. Summarizes practical requirements for inter-leaving papers.

23-223. **Stainless Steel Offset Plates.** Clements Batcheller. *Modern Lithography,* v. 13, June '45, pp. 51, 53, 55.

Process used to produce essential grain surface.

23-224. **Aircraft Oil Tanks of Magnesium Alloy.** J. B. West. *Aluminum & Magnesium,* v. 1, Aug. '45, pp. 16-19, 34.

Description of the particular type of tank serves to bring out the point that design and fabrication of such tanks is no simple cut-and-dried procedure. Use of magnesium alloys for such structures requires attention to detail and the following of good design practice.

23-225. **Sapphires From Aluminum.** Joan Penney. *Aluminum & Magnesium,* v. 1, Aug. '45, pp. 25, 35.

Finely powdered alumina is dusted into an oxyhydrogen flame at intervals, and the fused mass settles down on a thin pillar set in the furnace. As it is fed to the flame, the fused alumina builds up a long "white" sapphire crystal, shaped like a bullet, which is called by the French word "boule". A "boule" takes about five hours to grow to a size weighing about 300 carats, and it then has to be allowed to cool before it is split for shaping.

23-226. **Controlling Variables in Gear Production.** *Steel Processing,* v. 31, Aug. '45, pp. 503-507.

To attain maximum efficiency, high accuracy and extreme refinement are characteristic of all phases of gear production. Factors are: Steel quality; influence of grain flow; the carburizing process; carburizing temperatures; type of compound; grade of steel; heat treatment; cementitic cases.

23-227. **Aluminum Tank Gives Record Service.** *Railway Age,* v. 119, Sept. 8, '45, pp. 404-405.

Car with 8000-gal. capacity tank completes 17 years of service up to August, 1945, making a total of about 408,000 miles with relatively small cost for repairs.

23-228. **Making Steel Cartridge Cases for the Navy.** William E. McFee. *Modern Machine Shop,* v. 18, Sept. '45, pp. 124-132, 134, 136, 138.

First tried as a substitute for brass for cartridge case material, steel has proved to be practical and advantageous.

23-229. **Magnetic Core Laminations Produced at Minimum Cost.** Guy M. Shingledecker. *American Machinist,* v. 89, Sept. 13, '45, pp. 113-115.

Good selection of steel, use of progressive dies of sectional type and a closely controlled annealing procedure are essential in fabricating magnetic core laminations on a sound basis.

23-230. **Producing 240-Mm. Shell at Christy Park Works of National Tube Company.** *Industrial Heating,* v. 12, Sept. '45, pp. 1470-1472, 1474, 1476-1478, 1480, 1482, 1484, 1486, 1488, 1490, 1492, 1494, 1496, 1499, 1500, 1502.

Basic equipment used to produce the shell consists of two rotary-hearth furnaces for heating forging billets, a 1000-ton forging press, a hydraulically operated draw bench, heat treating furnaces, shell finishing lines, and other related facilities. Furnaces and processes described.

23-231. **Metallurgical Problems in Gas Turbines.** J. F. Cunningham, Jr. *Metal Progress,* v. 48, Sept. '45, pp. 484-488, 526.

Development of a gas turbine power plant for ship propulsion. Aim is to convert as much as possible of the energy in unburned liquid fuel into shaft horsepower.

23-232. **Burlington Vista-Dome Car.** *Railway Mechanical Engineer,* v. 119, Sept. '45, pp. 378-381.

Stainless steel car with glass-enclosed observation dome in the roof.

23-233. **Aircraft Engine Gears.** Forest R. McFarland. *SAE Journal,* v. 53, Sept. '45, pp. 511-520, 560.

Determination of causes of surface distress on existing reduction gears at the start of production and elimination of causes are described.

23-234. **Piston Rings in the War.** D. M. Smith. *SAE Journal,* v. 53, Sept. '45, pp. 521-530.

If a piston ring is to remain an effective seal over a long period of time, despite heat, pressure, corrosion, friction, and abrasion, it must be made from the proper material and it must be of the proper design.

23-235. **The Substitution of Blackplate for Tinplate in Cans for Fruit and Vegetables.** W. B. Adam and D. Dickinson. Iron and Steel Institute (Preprint), Aug. '45, 11 pp.

Effect of substituting lacquered blackplate ends for tinplate ends in fruit and vegetable cans. Points noted were rate of hydrogen formation in the cans, rate of dissolution of iron and tin, and the effect of the substitution on the color and flavor of the contents. The main conclusions were: Cold-reduced plate is superior to hot-rolled plate on blackplate ends covered with a single roller-coating of lacquer. Phosphating does not reduce the rate of internal corrosion and may increase it if the lacquer ad-

heres indifferently to the surface of the plate. Types of lacquer vary in the protection they afford. Rates of attack of the various fruits and vegetables on blackplate ends differ greatly and are highest for the acid fruits and beetroot. Substitution of blackplate for the bodies of cans as well as the ends is impracticable for general use.

23-236. **Structural Engineering in Railway Work.** Institute of Structural Engineers *Journal,* v. 23, April '45, pp. 169-195. *Engineers' Digest* (American Edition), v. 2, Aug. '45, p. 412.

Describes a number of typical examples of structural steelwork carried out by the L.M.S. Railway during the past ten years. Principal works described in detail are the reconstruction of Leeds (Wellington) Station, the construction of tranship shed at Derby and Birmingham, a locomotive testing station and a road motor workshop.

23-237. **The Final Touch.** *Die Casting,* v. 3, Sept. '45, pp. 26-28, 30, 45.

In Sunnen honing tools, die castings serve three primary purposes: As backing supports or blades; for the abrasive honing stones; as mandrels for carrying the holders; as replaceable guide and wear shoes for use with permanent type steel mandrels.

23-238. **From All Angles.** *Die Casting,* v. 3, Sept. '45, pp. 31-32, 34.

Wide angle binoculars have been designed for magnesium die castings with exceptionally good results especially in the attainment of thin wall sections.

23-239. **British Aluminum Permanent Mold Practice.** Jack W. Wheeler. *Modern Metals,* v. 1, Sept. '45, pp. 8-12.

Aluminum permanent mold castings were standard parts in many mobile engines in Britain prior to this last war. It is expected that due to a considerable reduction in the price of castings, they will be employed in many added applications in the new British automobiles. Tells of the close cooperation existing between foundry and consumer and also of some operations which have a direct bearing on low cost production.

23-240. **Magnesium in Portable Tools.** M. M. Moyle. *Modern Metals,* v. 1, Sept. '45, pp. 14-16.

Portable tools, used in most industries, must be both light and strong. Magnesium, no newcomer to this field, will unquestionably be used in increasing amounts in the days to come. Describes some magnesium applications which have proven themselves over a period of years, as well as some advantages to be gained through light weight tools.

23-241. **Aluminum Overhead Garage Doors.** *Modern Metals,* v. 1, Sept. '45, p. 17.

New and splendid application for aluminum. Aside from the light weight feature of aluminum for such a structure, the door's mechanism is installed in a small metal box which can be placed in an upper corner, out of the way. This allows for lower garage styling particularly where living quarters are planned over the garage.

23-242. **Cast Iron.** F. L. LaQue. *Iron and Steel,* v. 18, Aug. '45, pp. 375-378.
Corrosion data relating to plain and austenitic cast irons and applications of these and of high silicon irons are dealt with. (Gray Iron Founders' Society.) 21 ref.

23-243. **Precision Bolts and Studs.** *Automobile Engineer,* v. 35, Aug. '45, pp. 313-322.
Deals with many aspects of the manufacturing methods. Description given of the new pickling department. Cold-heading process on National Boltmaker machines is dealt with at some length, as are the special processes, swaging and centerless thread generation employed in the manufacture of Newallastic bolts and studs. Brief descriptions also given of the heat treatment equipment and equipment for manufacturing nuts. Methods of material and quality control are also discussed.

23-244. **Lead and Solder Wire.** *Wire Industry,* v. 12, Sept. '45, pp. 477-478.
Production methods and uses.

23-245. **Aluminum in the Electrical Industry.** M. C. Rowland. *Light Metal Age,* v. 3, Sept. '45, pp. 14-15, 49-50.
Important properties of aluminum other than light weight which give it great advantages in various electrical applications. Knowledge of these properties is valuable to the fabricator and may suggest other applications.

23-246. **Die Castings Extensively Used in Variable Speed Drive Redesign.** *Product Engineering,* v. 16, Oct. '45, pp. 660-662.
Although the necessary casting dies required a large investment, tooling costs are lower, and machining time is reduced. After making a reasonable allowance for tool amortization, over-all cost reduction is estimated to be about 60%.

23-247. **Fine Pitch Gears, II.** *Product Engineering,* v. 16, Oct. '45, pp. 710-713.
Deals with worms, worm gears, bevel gears, and backlash in gears.

23-248. **The Light Alloy Automobile.** *Light Metals,* v. 8, Sept. '45, pp. 417-426.
Practical advances projected in France during the past few years, special reference being made to the Mathis car. Use of light alloys in small automobiles, and the practical results of reduction of weight and drag.

23-249. **Light-Metal Boats.** *Light Metals,* v. 8, Sept. '45, p. 435.
Novel methods of construction developed during the past five years in Switzerland.

23-250. **Light Alloys in Motorized Bicycles and Motorcycles.** *Light Metals,* v. 8, Sept. '45, pp. 448-458.
Comprehensive survey based on accounts appearing in earlier issues brought up to date with additional matter, and including the results of a re-examination of some controversial issues.

23-251. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, Sept. '45, pp. 459-462.

Impregnating media employed in the manufacture of fixed paper condensers. Electrical properties, chemical, physical and mechanical characteristics of these media are examined.

23-252. **Precision Gears by High Production Methods.** John T. Smith. *Production Engineering & Management,* v. 16, Oct. '45, pp. 67-71.

Utilizing modern machines and modern methods, automotive engineers set new production records in turning out nearly 100 different types of high precision aircraft engine gears.

23-253. **Streamlined Production of Opposed Piston Diesel Engines.** *Production Engineering & Management,* v. 16, Oct. '45, pp. 78-89.

Special purpose tools and refined methods increase output and improve quality.

23-254. **Processing and Fabrication of Stainless Steel.** *Steel Processing,* v. 31, Sept. '45, pp. 567-573.

In processing and fabricating stainless steel sheets special practices apply which differ from those established for softer metals. Special characteristics which distinguish stainless steels from other metals. Shearing; forming; joining; machining; finishing.

23-255. **Manufacture of Close Tolerance Bolts.** *Aero Digest,* v. 51, Oct. 1, '45, pp. 66-67.

Raw material analyzed; heat treat sequence; second heat treatment; two passes of grinder.

23-256. **Lighter Engines From Stronger Alloys.** Carl T. Doman. *Aero Digest,* v. 51, Oct. 1, '45, pp. 87-88.

Advent of the higher strength gray iron alloys has opened a new approach to low cost, lightweight aircraft engine design.

23-257. **Magnesium and the Man on the Sreet.** T. W. Atkins. *Modern Metals,* v. 1, Oct. '45, p. 7.

Possibilities where magnesium products are suggested for use.

23-258. **Thin Magnesium Strip.** H. W. Porth. *Modern Metals,* v. 1, Oct. '45, pp. 13-18.

Thin gage or "Thinstrip" magnesium has been used advantageously for specific applications during the war. In the future, it may find usage for such instruments as pointers, damping vanes and moving "condenser" plates. Properties, fabrication, joining and uses of Thinstrip.

23-259. **Aluminum Butter Churns.** *Modern Metals,* v. 1, Oct. '45, pp. 24-25.

Why cast aluminum is used for butter churns.

23-260. **Alloy Steels for Maintenance.** J. A. Rosa. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 37-46.

Though perhaps higher in first cost, alloy steels save in replacement costs and in delay time. Their successful application requires intelligent analysis of duty requirements.

23-261. **Die Castings Solve Current Problems in Electrical Manufacturing.** *Die Casting,* v. 3, Oct. '45, pp. 21-23, 46-47.

Die castings hold their place in competition with stampings, plastic moldings, sand castings and other high-production elements and gain preference on some scores as engineers in the electrical manufacturing industry become better acquainted with the benefits obtainable by designing for their use.

23-262. **Shocking Experience.** *Dic Casting,* v. 3, Oct. '45, pp. 24-25, 61-62.

Operational efficiency and mechanical functions of the die castings used in aircraft armament indicate that their application can be considered where shock, vibration and extreme temperature variants must be tolerated.

23-263. **Eight Thousand Tons to Hold.** *Die Castings,* v. 3, Oct. '45, pp. 26-28, 54-56.

Die castings in railroad air brake equipment meet service requirements that are as severe as can be found under any conditions. Designs call for thick wall sections to withstand shock and vibration. Some of the components are among the heaviest die castings made.

23-264. **Die Castings in the Redesign of a Variable Speed Drive.** L. E. Jones. *Die Casting,* v. 3, Oct. '45, pp. 30-32, 34, 36, 48-49.

Using die castings instead of cast iron components in the redesign of this variable speed drive, manufacturing costs were reduced by more than 60%. The new model is more compact, lighter in weight, and outperforms the previous design.

23-265. **Carbon and Graphite for Mechanical and Electrical Parts.** F. J. Vosburgh. *Metals & Alloys,* v. 22, Sept. '45, pp. 721-726.

Properties and uses of standard, porous and impregnated carbon and graphite for a variety of products.

23-266. **Primary Factors in Choosing Aircraft Engine Materials.** Colin Carmichael. *Machine Design,* v. 17, Oct. '45, pp. 111-114.

Materials used by five of the leading aircraft engine manufacturers for 18 critical parts are compared, and the reasons for their selection; processes used in their fabrication discussed.

23-267. **Materials Problems in Gas Turbine Design.** J. F. Cunningham and R. A. Riester. *Machine Design,* v. 17, Oct. '45, pp. 119-122.

How the materials problems were solved in the case of the 2500-hp. gas turbine power plant recently built by Elliott Co. for the U. S. Navy. Design measures which had to be taken to minimize effects of distortion due to temperature differences, as well as to protect certain parts from excessive heat, explained. Leading characteristics of design and the factors affecting the choice of cycle.

23-268. **Selecting Materials for the Jeep. Part I.** Roger F. Mather. *Machine Design,* v. 17, Oct. '45, pp. 141-144.

Stresses general factors of importance in the selection of materials for all types of machines.

23-269. **Metal for a New Age.** W. J. Passingham. *Machinery* (Lloyd), v. 17, Sept. 1, '45, pp. 55-58.

Aluminum for prefabrication.

23-270. **Lead Products.** *Canadian Metals & Metallurgical Industries,* v. 8, Oct. '45, pp. 30-32.

Manufacture involves melting, casting, extrusion, rolling and burning.

23-271. **Mass Producing Rocket Projectiles at Westinghouse Plant.** W. G. Miller. *Industrial Heating,* v. 12, Oct. '45, pp. 1692-1696, 1698, 1700, 1800.

Infra-red drying of forgings; rough-machining operations; induction heating for nosing; heat treating; finish-machining operations; cleaning, painting and assembly.

23-272. **Chase Euclid Case Plant Produces Brass Cartridge Cases and Steel Mortar Shell, Part I.** *Industrial Heating,* v. 12, Oct. '45, pp. 1732-1734, 1736, 1798.

Operations involved in its production briefly described and somewhat detailed descriptions given of the equipment employed in the several steps of the manufacture.

23-273. **Manufacture of Woven Wire Conveyor Belts for High Temperature Service.** Fred L. Hooper. *Steel Processing,* v. 31, Oct. '45, pp. 645-648.

The one direction belt; the sectional belt; the balanced belt; the rod reinforced belts; final inspection; other developments.

23-274. **Materials for Producing the Atomic Bomb.** Kenneth Rose. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1054-1057.

Part played by metal-working plants, engineers and scientists in the development and production of the atomic bomb.

23-275. **The Silicones—Truly New Materials.** Harold A. Knight. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1069-1073.

Heat resistance; high temperature lubricants; silicone rubber; silicone coatings.

23-276. **Aluminum Bonded to Steel or Cast Iron.** M. G. Whitfield and V. Sheshunoff. *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1090-1096.

Process consists essentially of casting light metal, in the usual manner, against a specially prepared steel surface. A bond, formed at the interface of the two metals, has unique properties making it suitable for manufacture of various assemblies such as discharge tubes, radio transmission power tubes, plane exhaust stack heat exchangers, bearings and composite gears.

23-277. **Materials for Peacetime Products: Materials & Methods Manual No. 9.** *Materials & Methods* (Formerly *Metals & Alloys*), v. 22, Oct. '45, pp. 1105-1120.

New alloys—their characteristics and uses. The NE steels; low alloy steels; specialty steels; stainless steels and heat resisting alloys; tool and die materials; hard surfacing alloys; cast iron and steel; copper, brass and bronze; aluminum and magnesium alloys; zinc and its al-

loys; low melting metals (lead, tin, bismuth, etc.); powder metallurgy materials. Non-metallic engineering materials today.

23-278. **Magnesium on the March.** T. W. Atkins. *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 22, 36, 40.

Magnesium is taking its place beside other time-tried metals, but in the march it will forge ahead as consumers become convinced of its safety, lightness, durability and strength. (Address delivered at Second Annual Meeting of the Magnesium Association.)

23-279. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals,* v. 8, Oct. '45, pp. 479-484, 485-491.

Attention is directed to chemical properties in relationship to metal with which they come into contact.

23-280. **Light Alloys in Structural Engineering.** *Light Metals,* v. 8, Oct. '45, pp. 506-508.

Presents certain of the fundamental factors governing the successful adoption of light alloys for engineering structures. Shows the use to which some of these forms may be put in practice.

23-281. **Aluminum in the Coal-Gas Industry.** *Light Metals,* v. 8, Oct. '45, pp. 520-522.

Exhaustive survey of the theory and practice of the application of light alloys in coal-gas production and consumption.

23-282. **Applications of Meehanite to Die Casting Equipment.** H. K. and L. C. Barton. *Machinery* (London), v. 67, Sept. 27, '45, pp. 356-359.

Erosion of gray iron; structure of Meehanite; increased life of pots; strength of Meehanite castings.

23-283. **Some Applications of Welded Aircraft Tubing.** J. S. Adelson and Park Hill. *Western Metals,* v. 3, Oct. '45, pp. 28-30.

Deals with three types of tubing: Alloy 4130 and 8630 tubing for motor mounts, low carbon tubing for intake tubes, and stainless tubing for exhaust stacks.

23-284. **Aluminum Semi-Trailer.** *Modern Metals,* v. 1, Nov. '45, pp. 18-19.

Tells of a new all-aluminum refrigerated semi-trailer. Weight of the trailer cut 51% by using high-strength aluminum alloys. By eliminating dead, useless weight, the public will benefit by lower operating costs and cheaper maintenance.

23-285. **Aluminum for Boats.** *Modern Metals,* v. 1, Nov. '45, p. 21.

Use of aluminum for boats is rapidly expanding. Outlines additional developments for aluminum in this industry and gives a summary of a survey relative to use of materials in tomorrow's boats.

23-286. **Rectifiers in the Steel Industry.** F. Mohler. *Iron & Steel Engineer,* v. 22, Oct. '45, pp. 66-76.

Rectifiers show definite advantages for certain applications, and steady growth and improvement can be expected. They should not, however, be selected without

evaluating over-all economies and merits of each application.

23-287. **Thin Steel's Part in Reconversion.** Donald B. Stough. *Domestic Commerce,* v. 33, Nov. '45, pp. 18-20, 41.
Varied uses; war altered demand pattern; peacetime demand; jobbers and dealers; cold versus hot strip; closer tolerances; coatings on light steel; coats for many purposes; non-metallic coatings; special sheets and strips; fabricating improved.

23-288. **Lithium, Servant Metal.** Fred P. Peters. *Scientific American,* v. 173, Nov. '45, pp. 290-292.
As a scavenging agent, this lightest of all metals makes possible alloy castings that are stronger, less porous, and higher in electrical conductivity. Because of its extreme chemical activity it purifies alloys and gives them much finer grain structure.

23-289. **New Coach Design Makes Extensive Use of Aluminum.** *Product Engineering,* v. 16, Nov. '45, pp. 736-738.
High tensile aluminum alloy extrusions, castings and wrought sheet are used in the body structure of the new Twin Coach 32-44 passenger city-type coaches. Body is of semi-monocoque construction and is assembled by riveting. Interior trim is ⅛-in. masonite panels with aluminum extrusions.

23-290. **A Metallurgical Study of German Aircraft Engine and Airframe Parts.** *Metallurgia,* v. 32, Sept. '45, pp. 203-211.
Summary of further data resulting from the metallurgical examination of German aircraft engine and airframe parts.

23-291. **Selecting Materials for the Jeep, Part II.** Roger F. Mather. *Machine Design,* v. 17, Nov. '45, pp. 111-116.
Specific applications.

23-292. **Die Castings in the Construction of Light Machinery.** *Die Casting,* v. 3, Nov. '45, pp. 22-25, 58.
Dependability of die castings for mechanical functions has been successfully proved with their ever increasingly greater use by manufacturers of light machinery and allied products.

23-293. **Taking the Heat Off Die Castings.** T. A. Green. *Die Casting,* v. 3, Nov. '45, pp. 35, 36.
Die cast parts incorporate desirable features of simplicity, durability, and ease of operation in newly designed instrument.

23-294. **Bolting for Pipe Flanges and Pressure Vessels.** Sabin Crocker. *Fasteners,* v. 2, no. 4, '45, pp. 4-7.
Bolting material specifications; dimensional standards for bolting; chemical composition and physical properties of carbon and alloy steel bolting material.

23-295. **The German Fastener Industry.** C. F. Newpher. *Fasteners,* v. 2, no. 4, '45, pp. 19-22.
Survey of the German fastener industry to determine whether it had developed new products, methods, metallurgy, or anything which this country could use.

23-296. **Aluminum With Plastics in Building.** *Light Metals*, v. 8, Nov. '45, pp. 525-527.

Brief discussion on domestic and building units shown at a recent exhibition in London. Combined use of plastic and light metal, each material being employed in capacity to which it is functionally best suited.

23-297. **Aluminum in the Coal-Gas Industry.** *Light Metals*, v. 8, Nov. '45, pp. 528-541.

Special attention directed to the stability of aluminum in contact with chemicals produced during manufacture and processing of coal gas, and to eminent suitability of light metals for food industry employing gas heating.

23-298. **Women's Electrical Exhibition.** *Light Metals*, v. 8, Nov. '45, pp. 542-545.

Designers, industrial artists and craftsmen cooperated to achieve striking presentation in aluminum and plastics.

23-299. **Light Alloys in Rectifiers, Photocells and Condensers.** *Light Metals*, v. 8, Nov. '45, pp. 559-576.

Discussion on relationship between impregnated media and service characteristics and life of fixed-paper condensers.

23-300. **Equipment Set-Up at Brad-Foote Gear Works.** Joseph Geschelin. *Automotive & Aviation Industries*, v. 93, Nov. 1, '45, pp. 36-38, 40, 42, 44, 78.

To make all types of gears in wide variety of sizes.

23-301. **Cast Iron in the Process Industries.** F. L. LaQue. *Chemical Age*, v. 53, Nov. 3, '45, pp. 413-416.

Some points for the chemical engineer. 10 ref.

23-302. **Two-in-One Materials.** Fred P. Peters. *Scientific American*, v. 173, Dec. '45, pp. 342-344.

Plating, hot dipping, powder metallurgy, inserting, and cladding, offer virtually new materials with desirable properties for many specific purposes. Plastics plus metals and a new aluminum-cast-to-steel process open many fields of application hitherto undeveloped.

23-303. **Steel Floor Plates Resist Heavy Trucking Wear.** J. A. Finneran. *Factory Management & Maintenance*, v. 103, Dec. '45, p. 155.

Average truckload weighs about 3000 lb. Plates ¼ in. thick, 6 ft. wide, and 12 ft. long, with a diamond pattern rolled in to reduce the slipping hazard, laid in places where trucking is heaviest and floors in poorest condition. Deterioration of the floor, caused by trucking, stopped immediately.

23-304. **Wire Reels.** *Steel*, v. 117, Nov. 26, '45, p. 108.

Redesigned for fabrication from alloy steel; provide both strength and lightness.

23-305. **Metal-Plastic Composites.** C. R. Simmons. *Materials & Methods*, v. 22, Nov. '45, pp. 1426-1427.

Advantages of plastics and metal combined in product through careful selection and design.

23-306. **Glycerine in Metal Treatment.** Georgia Leffingwell and Milton A. Lesser. *Materials & Methods*, v. 22, Nov. '45, pp. 1432-1434.

Glycerine can be used in quenching, cleaning, plating, anodizing, electropolishing, soldering. 24 ref.

23-307. **Testing, Inspection and Other Operations in Cast-Steel Bomb Production.** *Machinery* (London), v. 67, Nov. 15, '45, pp. 505-510.

Deals with certain machining operations and inspection and testing of the bomb bodies.

23-308. **Increased Use of High Strength Steels in Structural Applications Seen.** *Steel,* v. 117, Dec. 3, '45, pp. 102-104.

Weight saving and corrosion resistant qualities make them especially desirable for mobile equipment. Provide greater payload, enable faster operations than heavier steels. Spread in prices narrowed in recent years.

23-309. **Seamless Steel Tubes—I.** H. Sanders. *British Steelmaker,* v. 11, Nov. '45, pp. 500-504.

Basic operations required for their production, and metallurgical facts on which their manufacture is founded.

23-310. **Nickel Steels, Cast Irons and Other Nickel Alloys Applied in Tool Engineering.** T. N. Armstrong and J. S. Vanick. *Tool Engineer,* v. 15, Nov. '45, pp. 24-30.

Materials, their selection, uses and processing comprehensively defined.

23-311. **Pump Shaft Seal.** *Product Engineering,* v. 16, Dec. '45, p. 832.

Heat resistant and non-corrosive are the characteristics of new seal; available in both bronze and stainless steel.

23-312. **Sealed Electrical Bushings for Climate-Proofing Equipment.** H. H. Hausner. *Product Engineering,* v. 16, Dec. '45, pp. 849-853.

Metal-to-ceramics seals, their manufacture, properties and applications for hermetically sealing electronic and electromechanical equipment discussed; climatic factors analyzed and related to flashover voltage. 20 ref.

23-313. **Steel Packaging.** Walter L. Hardy. *Steel,* v. 117, Dec. 17, '45, pp. 96-98, 138, 141-142.

Re-usable and re-sealable steel drums for export shipment and prolonged storage of engines, motors and instruments of all types exceed expectations of AAF. Absolute moisture-proofing and high safety recommend containers for commercial use.

23-314. **New Uses for Hardsteel.** *Iron Age,* v. 156, Dec. 13, '45, p. 68.

Hardsteel cutting tool said to possess exceptionally high red hardness, will take very heavy cuts at high speeds, and is particularly adaptable to heavy roughing cuts where considerable scale is encountered. Does a particularly fine job on non-ferrous metals.

SECTION XXIV

DESIGN

24-1. **"Blue Printing" on Metal.** H. J. Christy. *Metal Progress,* v. 47, Jan. '45, p. 94.

Methods available for direct printing of full scale inked drawings from tracing paper or linen.

24-2. **Pre-Production Technique.** H. G. Barnett. *Aircraft Production,* v. 6, Dec. '44, pp. 575-579.

Full-scale layout and template reproduction; application of Robinson A. C. T. Process.

24-3. **Analysis of Unbalanced Forces in Multicylinder Gear Drives.** Sergei G. Guins. *Product Engineering,* v. 16, Jan. '45, pp. 40-43.

Investigation of rotating and reciprocating forces present in a mechanism consisting of single cylinder units mounted around and driving a common spur gear. Test observations and oscillograph pictures confirm conclusions deduced from summations of moment and force equations referred to the center of the system.

24-4. **Drawing Office Practice in Die Design.** H. K. and L. C. Barton. *Machinery* (London), v. 65, Nov. 30, '44, pp. 607-610.

Standardization of practice in drafting by giving the production departments only one set of conventions with which to familiarize themselves, has a marked effect in reducing the liability of error of misinterpretation during die construction. Adoption of British Standard recommendations effects closer relationship of drafting practice with the practical requirements of the production departments.

24-5. **"Edge-Up" Forming Dies.** C. W. Hinman. *Steel Processing,* v. 30, Dec. '44, pp. 788-790.

Unusual design of a forming die that produces many variations of long sectional shapes from sheet steels and other sheet metals. Forms certain shapes that cannot be done on a press brake in one operation, unless this die is used. Application of the old hinge-pin principle.

24-6. **Photographic Reproduction for Aircraft Layout.** *Machinery* (London), v. 65, Dec. 7, '44, pp. 631-635.

Preparation of layout blanks; layout section; processing.

24-7. **Specifying Rational Tolerances for Interchangeability, Low Cost.** F. A. Wedberg. *Machine Design,* v. 17, Jan. '45, pp. 117-122.

Tolerances in design; many phases of engineering involved; closer collaboration required; tolerances in a machine-part assembly; factors applying to control-surface tabs.

24-8. **Bevel Gears as Applied in Lightweight Designs.** L. J. O'Brien. *Machine Design,* v. 17, Jan. '45, pp. 147-152.

Factors affecting bevel gear selection; checking tooth strength; new design data forthcoming; curvic spline couplings and clutches. (Abstract of a paper presented at the National Aeronautic Meeting of the Society of Automotive Engineers in Los Angeles.)

24-9. **Pre-Production Technique.** *Aircraft Production,* v. 7, Jan. '45, pp. 38-42.

Photographic scale reproduction of original full-scale layouts. Equipment and procedure.

24-10. **Truss Design.** *Steel,* v. 116, Jan. 22, '45, pp. 110-112.

Puts all web members in vertical plane to eliminate gusset plates and facilitate assembly.

24-11. **Cost Analysis in a Product Redesign.** Cecil L. Wilder. *Die Casting,* v. 3, Jan. '45, pp. 34-39.

The proper approach to an analysis of total costs should be based on a per unit breakdown. Often great disparity between two preliminary cost figures of two different methods of fabrication may prove to be more apparent than real. Article is based on conditions peculiar to one manufacturer, but the principle might well be considered more often in cost analysis work.

24-12. **Design Rules—Part 10.** Herbert Chase. *Die Casting,* v. 3, Jan. '45, pp. 50-52, 54-55.

When two or more parts commonly made separately and subsequently assembled, are involved, study the possibility of producing these units in the form of a single die casting.

24-13. **Mathematical Basis for the Design of Cutting Tools for a Milling Machine.** Condensation by B. W. Heise. *V.D.I. Zeitschrift,* v. 88, Feb. 19, '44, p. 100.

24-14. **Design of Dies for Rubber-Die Press Work.** *Machinery* (London), v. 65, Dec. 28, '44, pp. 709-712.

Points of importance in designing the tools: Edges of the die should be given as large a radius as possible to obviate cracking of the blank; die should be at least ¼ in. deeper than the flange which is to be formed; to allow for springback, a backing angle of approximately 4° may be provided on the side faces of the die; provision should be made for location pins with large-diameter mushroom heads to position the blank from selected tooling holes.

24-15. **Drawing Office Practice in Die Design.** H. K. and L. C. Barton. *Machinery* (London), v. 65, Dec. 28, '44, pp. 722-725.

Die construction methods; sprue holes; inserts; hand-operated cores.

24-16. **Design of Welded Machinery.** John Mikulak. *Welding Journal,* v. 24, Jan. '45, pp. 13-21.

There are many inherent characteristics of the welding art which require special consideration and sets it apart from other forms of fabrication.

24-17. **Designing of "Trouble-Free" Dies.** C. W. Hinman. *Modern Industrial Press,* v. 7, Jan. '45, pp. 18, 20.

High precision progressive dies.

24-18. **Aluminum Redesign of a Steel Truck.** William Graf. *Light Metal Age,* v. 3, Jan. '45, pp. 10-13.

Weight saving of 31 to 70% (depending on structural alloy used), decreased production cost and a sturdier product.

24-19. **Profit Shared Through Cooperation.** William S. Thomas. *Foundry,* v. 73, Feb. '45, pp. 88, 210, 212, 214, 216.

Designer must work in close contact with the foundryman to avoid or minimize defects; hot tears and shrinkage cavities usually are attributable to poor design; mold design should be considered before the pattern is laid out on the drawing board; examples show satisfactory results brought about by cooperation.

24-20. **Machine Tools for Tomorrow.** Joseph L. Trecker. *Production Engineering & Management,* v. 15, Feb. '45, pp. 102-103, 120.

Postwar forecast on trends in design and sales of metal-cutting equipment after victory is won.

24-21. **Permissible Angularity of Drill Bushings.** H. W. Palkowski. *Production Engineering & Management,* v. 15, Feb. '45, p. 99.

Formula for determining tolerance or permissible angularity of bushed holes.

24-22. **Current and Future Trends in General Industrial Design.** Harold Van Doren. *Metals and Alloys,* v. 21, Jan. '45, p. 84.

Progress made in industrial design during war years. New definition of industrial design given.

24-23. **Die Within a Die.** *Die Casting,* v. 3, Feb. '45, pp. 42, 44.

A special die design technique that makes possible the casting of a male thread having an axis parallel rather than at right angles to the direction of the die motion.

24-24. **How High Speed Photography Aids in Redesign.** W. S. Calvert and H. D. Jackes. *Machine Design,* v. 17, Feb. '45, pp. 133-138.

Studies indicative of the motion analyses possible with high speed photography. Many design problems where dynamics become so involved that it is necessary to study actual operations in this way to ascertain how they agree with calculated performance.

24-25. **The Dimensioning of Production Drawings.** W. Barnes. *Machinery* (London), v. 66, Jan. 25, '45, pp. 89-92.

Object in making production drawings and essential requirements. Methods of dimensioning; fundamental principle in dimensioning.

24-26. **Three-Dimensional Contour Control Advances Art of Pattern and Model Making.** *Tool & Die Journal,* v. 10, Feb. '45, pp. 101-103.

New contour controlling technique bids to revolutionize the making of plaster models to intricate contours or profiles. Equipment is known as the Contour Developer and is a product of the Contour Co. of Pasadena.

24-27. **Magnesium Alloys in Design.** E. W. Thomas. *Engineering,* v. 159, Feb. 2, '45, p. 84.

Discussion of design and limiting load.

24-28. **Structural Design Problems of Light Aircraft.** Stanford J. Stelle. *Aeronautical Engineering Review,* v. 4, Feb. '45, pp. 27, 29, 31-32, 37.

If the difficulties outlined are overcome in future light airplanes, the airplanes will cost a fortune, and, because of weight, will be limited to running down some well-paved high-way. It is hoped, however, that such will not be the case and that there will be devised ways and means to produce low cost, well-performing, trouble-free light airplanes. The present ones are good —future ones will be better.

24-29. **Designing of "Trouble-Free" Dies, XLV.** C. W. Hinman. *Modern Industrial Press,* v. 7, Feb. '45, pp. 18, 20.

New ideas for lubricating machines have recently been put in practice that will greatly increase the working life of machines. Up-to-date pressrooms are also beginning to use these ideas. The new Alemite "Coloroute" system is one plan, and in another plan it has been proposed to build a centralized lubricating system as integral equipment within every new machine. The latter plan is of course the ideal condition.

24-30. **Some Basic Principles of Plasticity for Die Designers.** William Schroeder. *Modern Industrial Press,* v. 7, Feb. '45, pp. 30, 32, 34.

Some of the most fundamental and valuable principles of plasticity reviewed. 6 ref.

24-31. **Solving Compound-Angle Problems.** Holbrook L. Horton. *Machinery,* v. 51, March '45, pp. 177-183.

Fundamental types of problems to be considered.

24-32. **Design Rules—XI.** Herbert Chase. *Die Casting,* v. 3, March '45, pp. 24, 27, 29, 31, 32, 51-52.

Use of inserts wherever results cannot be secured by other expedients at lower cost, or where economies not otherwise attained are realized.

24-33. **Gaskets in Design.** Roger W. Bolz. *Machine Design,* v. 17, March '45, pp. 151-156.

General steps that may be followed as an aid in the selection of compression gaskets, regardless of the nature of the equipment in which they are to be used or the details of the closure design.

24-34. **Production Processes and Methods, for Present and Postwar Uses.** *Product Engineering,* v. 16, April '45, pp. 249-264.

Review of various production processes, their inherent characteristics and features, and their influence and effect upon the design of products and machines. Casting, forming, assembly, and heating methods and surface treatment.

24-35. **The Measurement of Thread Form for Screws of Moderate Rake.** *Machinery* (London), v. 66, March 29, '45, p. 339.

Diagram represents both axial and normal sections of a thread whose fundamental triangle has a depth d and pitch p.

24-36. **Formed Sheet Metal Parts Classified by Shape, III.** Mark P. Meinel. *Product Engineering,* v. 16, May '45, pp. 334-338.

A classification of formed sheet metal parts, particularly applicable to aluminum alloys, discussed from the standpoint of design of such parts to simplify production. Suitable production methods and machines for each class given.

24-37. **The Use of Dowel-Pins in Precision Tool Design.** E. E. J. *Machinery* (London), v. 66, April 5, '45, pp. 372-373.

Dowel-pins should be employed for locating purposes only and never to replace a screw for fastening purposes. General rules given.

24-38. **Producing Template Negatives on the Draftsman's Table.** *Iron Age,* v. 155, May 10, '45, pp. 84-85.

Photographic device making possible the production of negatives of changes on drawings while on the draftsman's table, eliminating many delays; enables engineers to make small spot reproductions from larger master line drawings.

24-39. **Refining the Design of a Thread Roller.** Richard K. Lotz. *Machine Design,* v. 17, May '45, pp. 99-104.

Employment of cylindrical rotating dies makes available die surfaces of infinite length. This extension of die surface obviates one of the primary drawbacks of flat-die rolling—"rapid penetration."

24-40. **A Designer Looks at Light Metals.** George Walker. *Modern Metals,* v. 1, April '45, pp. 10-13.

Designer's conception of some things that can be expected for light metals in tomorrow's planning.

24-41. **Theory of Bending, Torsion and Buckling of Thin-Walled Members of Open Cross Section.** Stephen P. Timoshenko. Franklin Institute *Journal,* v. 239, May '45, pp. 343-361.

Mathematical development of formulae.

24-42. **Steel as a Material.** E. P. Strothman. *SAE Journal,* v. 53, June '45, pp. 314-320, 344.

Reviews the advantages of steel. Gives examples of parts that were not only stronger and more easily fabricated when made of steel but actually a little lighter.

It does not follow that steel should replace light metals in every case. It means, rather, that when a part is being designed, all possible materials should be considered, particular consideration being given to the ratio of strength to weight and the modulus of elasticity of each material.

24-43. **Design of Torsion Rod Springs Used in M-18 Tank Destroyer.** *Product Engineering,* v. 16, June '45, pp. 390-392.

Design of a torsion rod spring discussed as to its application, stress range, creep and fatigue life. Points out many steps in manufacture which are critical to obtain a satisfactory design. Methods used in cold working and shot peening described.

24-44. **Torsional Rigidity Calculations for Waffle Type Construction.** John H. Meyer. *Product Engineering,* v. 16, June '45, pp. 393-394.

Comparisons of actual and computed torsional deflections in a specimen door of waffle type, spot-welded construction. Test showed that torsional deformation was about three times that calculated by conventional methods. A procedure for calculating the amount of deformation in waffle panels presented as a basis for empirical design.

24-45. **Practical Research Shows Way to More Economical Bridge Design.** *Railway Age,* v. 118, June 9, '45, pp. 1014-1016, 1021.

Tests on short beam and girder spans by A.A.R. indicate that lower impact values can be used in these structures, with substantial savings in steel.

24-46. **A Method of Measuring Triaxial Residual Stress in Plates.** D. Rosenthal and J. T. Norton. *Welding Journal,* v. 24, May '45, pp. 295s-307s.

Advantage of procedure lies in that by properly selecting the shape and size of the element, the change of stress can be made to follow a known law of relaxation across the thickness. In the case of the welded plates the element is simply a rectangular block. 9 ref.

24-47. **Design Rules—XIII.** Herbert Chase. *Die Casting,* v. 3, May '45, pp. 30, 32-34, 36.

Where good appearance in a die casting is essential, see that its proportions, contours and details are such as to be pleasing to the eye and in keeping with the function that the casting must perform as well as in harmony with other parts of the assembly of which the casting is a part.

24-48. **Designing of "Trouble-Free" Dies—XLVIII.** C. W. Hinman. *Modern Industrial Press,* v. 7, May '45, pp. 18, 34.

Welding for the war and peace. Resistance forge welding; "refrigerated" spot welding; assembling and spot-welding bomb fins; one of the "lines behind the lines."

24-49. **Metallurgy and Design.** H. L. Lexier. *Canadian Metals and Metallurgical Industries,* v. 8, May '45, pp. 25-29.

Exact knowledge of stresses aids economical construction. Discusses problems which confront the designer. Brief description of several of the new instruments and machines available to the designing and metallurgical engineers which enable them to develop and prove new designs with an accuracy never before possible. Fatigue; internal stress; selection of material; strain gages; brittle lacquers; photo-elasticity; X-ray diffraction. 2 ref.

24-50. **Determination of Location Tolerances.** D. Eastwood. *Machinery* (London), v. 66, May 3, '45, pp. 479-481.

Outlines method of approaching the subject, with special reference to location tolerances of holes in jigs, fixtures, dies and templates.

24-51. **Diamond-Pin Calculation Assures Correct Part Location.** Edward J. Chartier. *American Machinist,* v. 89, June 7, '45, p. 121.

With the equations provided the tool designer can check whether the diamond pin will locate the piece correctly in the fixture.

24-52. **Die Castings in Motion.** *Die Casting,* v. 3, June '45, pp. 30-32, 34-35.

Study of a variety of design applications in cams, levers, flexible coupling, pulleys, gears and sprockets, which are commonly used in machine components; have favorable properties.

24-53. **Stresses in a Cylindrical Shell Due to Nozzle or Pipe Connection.** G. J. Schoessow and L. F. Kooistra. *Journal of Applied Mechanics,* v. 12, June '45, pp. A-107—A-112.

Results reported of a strain-gage test conducted on a 54-in. diameter cylindrical shell to which were attached two 12-in. diameter pipes. The pipes were subjected to direct axial-tension loading, direct axial-compression loading, and transverse bending moments.

24-54. **Improving Design with Tubular Sections.** Roger W. Bolz. *Machine Design,* v. 17, June '45, pp. 111-115.

Tubing—seamless or welded products—provides a range of application and usefulness that covers the entire field of design. Strength and weight characteristics, fine surface finish, close dimensional accuracy, excellent machinability, and heat treatability of commercial and special tubing are other advantageous properties.

24-55. **How to Measure Stresses in Machines.** B. F. Langer. *Machine Design,* v. 17, June '45, pp. 123-127.

Reviews the more important methods now available for the experimental solution of stress problems which cannot be solved by analysis alone. Available methods listed under the headings mechanical, optical, and electrical. 19 ref.

24-56. **Design of Exhaust System, XI.** F. H. Stebbins. *Sheet Metal Worker,* v. 36, June '45, pp. 50-54.

Calculating pipe sizes by the area load method.

24-57. **Some Developments in Modern Transformer Design.** W. W. Satterlee. *Iron & Steel Engineer,* v. 22, June '45, pp. 62-70.

Improvements in the design and construction of transformers have reduced costs and increased reliability. The dry type, air cooled designs offer many advantages and have proven themselves in operation.

24-58. **Magnesium Design Considerations and Applications.** John C. Mathes. *Mechanical Engineering,* v. 67, July '45, pp. 468-472.

Design; sand castings; die castings; bending; application to aircraft.

24-59. **Welded Steel Stampings Provide Innovation in Wheel Design.** *Steel Processing,* v. 31, June '45, pp. 385-386.

Welded wheel composed of stamped steel has been developed for Army tanks. Simple design of the tank bogie wheel from which the truck and trailer wheel evolved is shown.

24-60. **Steel Weldments Offer Freedom of Design.** Harold G. MacGregor. *Production Engineering and Management,* v. 16, July '45, pp. 74-76.

Greater freedom, both in design of new products and redesign of old, is possible for designers who understand weldment as a basic structural tool, rather than an adaptation or substitute for earlier means of joining two or more sections of steel.

24-61. **Production Illustration in Axonometric Projection.** W. Ingham and W. H. Thorn. *Production Engineering and Management,* v. 16, July '45, pp. 101-102, 104-105.

Use of trimetric projection makes illustration not only pleasing to the eye, but mathematically and graphically accurate as well. It removes technical illustration from the realm of supplementary drawing, and enables the engineer to prepare many of his necessary drawings in pictorial form.

24-62. **Revised Process Speeds Production of Mirror-Image Templates.** Thomas A. Dickinson. *Modern Industrial Press,* v. 7, June '45, pp. 33-34, 38.

Great savings in time are now being achieved by means of a revised offset litho process which enables template makers to produce "mirror-image" patterns from master layouts for a single side of an air-frame.

24-63. **Design Tips for Plastic Coating for Corrosion Resistance.** Kenneth Tator. *Corrosion & Material Protection,* v. 2, June '45, pp. 14-17.

Modifications in design offered as suggestions. Basic principles: Liquids retract from sharp edges or burrs; liquids accumulate in corners or acute angles; liquids will not flow up-hill.

24-64. **Production Processes — Their Influence on Design, I.** Roger W. Bolz. *Machine Design,* v. 17, July '45, pp. 109-114.

Broaching.

24-65. **Working Stresses for Helical Springs.** A. M. Wahl. *Machine Design,* v. 17, July '45, pp. 129-134.

Discusses some of the fundamental principles underlying the choice of working stresses in springs. Reasons for the wide variation in working stress used in practical design. Emphasis given to the significance of the various stresses calculated by methods in common use. Utilization of these fundamental principles in practical design illustrated by reference to actual designs of springs used in industrial and railway work. Limited to steel round-wire springs and to cases where normal temperatures and no corrosion are involved. Values of working stresses used by the Ordnance Department and by spring manufacturers given.

24-66. **Strength of Magnesium Alloy Columns.** F. A. Rappleyea. *Journal of the Aeronautical Sciences,* v. 12, July '45, pp. 339-344.

To present data for designing magnesium alloy columns, tests on round bars of various commercial magnesium alloys were made. Two sets of end conditions were used—pin-ended and flat-ended. The pin-ended tests were conducted using carefully machined semispheric ends, a modified version of a jig proposed by J. A. Van den Brock. The flat-ended tests were made between two closely ground platens. Various types of formulas were studied for applicability to design use. 9 ref.

24-67. **An Analytical Method of Cam Design.** W. B. Carver and B. E. Quinn. *Mechanical Engineering,* v. 67, Aug. '45, pp. 523-526.

Analytical method yields four items of information that are of value in designing a disk cam with a flat-faced radial follower: Minimum radius of the cam can easily be found; minimum length of follower face can be determined; location of the point of contact can be found; parametric equations of the cam contour can be determined.

24-68. **Structural Discontinuities Modify Stress Distribution.** B. C. Boulton. *Product Engineering,* v. 16, Aug. '45, pp. 505-510.

Analysis of conditions that produce local stress concentrations and the effect of structural irregularities and discontinuities on the distribution of stress in critical sections. Effect of notches in reducing the maximum strain obtainable before failure. Strain sensitivity of a material to notches as related to the shape of the stress-strain curve.

24-69. **Analysis of Gear Tooth Contact by Line of Action Drawings.** Fred Bohle. *Product Engineering,* v. 16, Aug. '45, pp. 532-536.

Line of action drawings based on actual machine processes and tools used in cutting gears show the true tooth shapes, width of flat at top of teeth, fillets, undercut, length of line of action, base pitch and presence of interference. Methods for improving strength and accuracy are discussed.

24-70. **Torsion Bar Suspension, Developed by Buick, Is Major Feature of Famous Hellcat.** *Steel Processing,* v. 31, July '45, pp. 430-433.

Effectiveness of suspension; suspension in operation; importance in tank design; production of torsion bars; sequence of manufacture; operation—equipment.

24-71. **Forging Die Design.** John Mueller. *Steel Processing,* v. 31, July '45, pp. 438-439, 454.

Of importance in forging design is the avoidance of thin sectioned forgings. Flat, thin sectioned forgings are undesirable, because of the excessive hammer blows required to pound the forging down to size, and because of the excessive strain and wear on the hammer dies. Transition from thin to thick should be as gradual as possible, avoiding all abrupt sectional changes.

24-72. **Design and Operation of Modern Progressive Dies.** C. W. Hinman. *Steel Processing,* v. 31, July '45, pp. 446-448.

Series of die operations grouped at each of several consecutive stations. Each operation is cut into a strip of metal which is passed over the dies and under the punches. In the last station of the die, the work is cut from the strip and drops through the die, or is blown by compressed air from the surface of the die. Progressive dies generally complete the work piece at the last station.

24-73. **What Physical Tests on Die Casting Mean to Designers.** *Die Casting,* v. 3, Aug. '45, pp. 22-24, 45, 46.

Summary of the physical properties of the principal die casting alloys; data compiled for the product designer as an aid in the selection of the proper alloy for meeting service requirements.

24-74. **Interchangeability.** C. A. Gladman. *Automobile Engineer,* v. 35, July '45, pp. 267-270.

Basic principles underlying the application of tolerances.

24-75. **Improving Design Trough Life Testing.** R. E. Peterson. *Machine Design,* v. 17, Aug. '45, pp. 127-130.

Life testing, field tests, laboratory tests of conventional specimens, stress analysis, and studies of mechanics of materials all have a proper place in the overall picture, and if we wish to make the most effective progress in basic design practice we should plan our work so that the results obtained in these fields can be correlated in a fundamental manner.

24-76. **Photo-Elasticity and Design Problems, Part I.** R. B. Heywood. *Aircraft Engineering,* v. 17, July '45, pp. 195-196.

Modern technique; determination of stress from the fringes.

24-77. **Some Applications of Metal Science to Design.** W. O. Richmond. *Western Miner,* v. 18, Sept. '45, pp. 46-48.

Deals with stresses, how they are described, how they are measured, and, in some degree, how they affect the material which is carrying them.

24-78. Involute Gear Calculations Simplified. Allan H. Candee. *American Machinist,* v. 89, Sept. 13, '45, pp. 122-128.

Tables of a factor k derived for changes in center distance and tooth thickness provide a short cut when designing and generating involute spur gears.

24-79. Latitude in the Design of Spiral Gears. W. A. Tuplin. *Machinery* (London), v. 67, July 26, '45, pp. 91-93.

Labor-saving method: examples.

24-80. Screen Test. Bernard J. Wolfe. *Die Casting,* v. 3, Sept. '45, pp. 20-21, 46, 48.

In designing projector, much thought was given to the ease and economy of assembly. With properly placed holes and cast ribs the only assembly tool required is a screw driver.

24-81. Stoking up for Competitive Selling. E. F. Biddle. *Die Casting,* v. 3, Sept. '45, pp. 22-24.

Advantages of redesigning for die castings. With the use of die castings manufacturing costs were reduced and a more efficient product resulted.

24-82. Die Castings Instrumental in Design Economies. *Die Casting,* v. 3, Sept. '45, pp. 56-59.

Die cost is moderate, castings require a minimum of machine work because close dimensions, as cast, are held, sections can be comparatively thin, making for light weight, and the alloys available meet a considerable range of requirements.

24-83. Projected Designs for Lightweight Automobiles. W. C. Nichols and Joseph Palma. *Modern Metals,* v, 1, Sept. '45, pp. 4-7.

Thinking around automotive circles is definitely in the direction of decreasing weight. Public awareness; must redesign; automotive design; wider doors; grilles; bumpers; hoods; wheels; car interior.

24-84. Formula for Design of Cam Clamps. Alfred R. Goatley. *Tool Engineer,* v. 15, Sept. '45, p. 45.

Mathematics for determining a mean average, between angular extremes, essential to secure clamping.

24-85. Designing Computing Mechanisms. Part II. Macon Fry. *Machine Design,* v. 17, Sept. '45, pp. 113-120.

Mechanisms consist of certain basic elements which by themselves are readily understandable. Designers of other machines and control equipment will find new uses for such mechanisms; multiplying and dividing; offset follower; manufacture of gear gams; geometric computation of trig function; when resultant of components is needed; range of tangent and secant mechanism limited.

24-86. Stress Distribution. E. S. Clark. *Steel,* v. 117, Sept. 24, '45, pp. 116, 146.

Check list of current, accepted methods for determination of stresses which will prove helpful to those following the present tendency to limit by the more effective use of materials.

24-87. **An Accurate Method for Laying Out Involute Gear Teeth.** L. Wilson. *Machinery* (London), v. 67, Sept. 13, '45, pp. 292-293.

Optical projector provides a useful means of checking the profile of the teeth of small gears and pinions. Indicates a method by which accurate charts of enlarged-tooth forms can be made.

24-88. **Light Alloys in Structural Engineering.** *Light Metals,* v. 8, Sept. '45, pp. 463-468.

Theory and practice of light design with and without the use of light alloys, indicating the special features of structures in the latter materials. (Koenig *Technische Rundschau,* no. 32 and 33, Aug. 4 and 11, '44.)

24-89. **Design of Tools and Fixtures.** *Machinery,* v. 52, Oct. '45, pp. 189-191.

Automatic hopper-fed knurling fixture; gage for checking special screw threads by single-wire method.

24-90. **Method of Evaluating Test Data Aids Design of Rotary Pumps.** Warren E. Wilson. *Product Engineering,* v. 16, Oct. '45, pp. 653-656.

Principles of a method for analyzing data obtained by testing rotary positive displacement pumps and motors that graphically enumerates the effects of all design factors which influence performance. Method developed on the basis of the elementary theory underlying the mechanics of hydraulic pumps and motors.

24-91. **Internal Wrenching Bolts Design Data and Uses.** L. J. Catlin. *Product Engineering,* v. 16, Oct. '45, pp. 714-715.

High strength internal wrenching bolts described. Advantages of these bolts when used to replace standard hexagon head bolts in shear and tension attachments discussed.

24-92. **Basic Relationships of Bevel Gears.** Ernest Wildhaber. *American Machinist,* v. 89, Sept. 27, '45, pp. 99-102.

Basic bevel gear formulas are rederived. Profile sliding treated in a new way.

24-93. **Do's and Don'ts in Die Casting Design. Part I.** *Die Casting,* v. 3, Oct. '45, pp. 58-60.

Tips on the design of die castings.

24-94. **Experimental Stress Analysis Improves Design.** Martin A. Erickson. *Tool Engineer,* v. 15, Oct. '45, pp. 18-26.

New approaches, breaking with traditional methods of design, result in greater structural strength with less material.

24-95. **The Elements of Gearing.** *Tool Engineer,* v. 15, Oct. '45, pp. 38-39.

Discusses tooth forms and the elementary arithmetic of gears.

24-96. **Designing Computing Mechanisms. Part III.** Macon Fry. *Machine Design,* v. 17, Oct. '45, pp. 123-128, 186.

Cam mechanisms offer simple method; avoiding undercut; how the master cam is made; cutter movement corresponds to follower motion; disk cam is most compact type; how three-dimensional cam works; a powerful computing tool; employing several gear cams in series; cut-

ting the teeth of non-circular gears; tape wheels can use helicoidal surfaces.

24-97. **A New Drawing Office Appliance.** *Aircraft Engineering*, v. 17, Aug. '45, pp. 242-244.

Technique, which includes a machine that cuts 50 to 80% off the time required to prepare a trimetric drawing and four new drawing instruments, that offer promise of considerable simplification.

24-98. **Special Analysis of Gear Mesh Clarifies Curvature Conditions.** Ernest Wildhaber. *American Machinist*, v. 89, Oct. 25, '45, pp. 122-125.

Duplex generation method gains in popularity and corrects bias bearing of gear teeth. Necessity of special gear blanks is shown in this concluding installment.

24-99. **Design Analysis of Messerschmitt Me-262 Jet Fighter, Part I.** John Foster. *Aviation*, v. 44, Oct. '45, pp. 115-135.

First detailed engineering study of Germany's top jet propelled fighter reveals many unorthodox design and construction features and shows the importance of the production engineer in its development.

24-100. **Theory of the Involute Gear.** R. Stanley Wright. *Western Machinery and Steel World*, v. 36, Oct. '45, pp. 457-459.

Best gear design for a desired speed change is a compromise of the following points: Pressure angle, the best portions of involute curve, available cutters, and gear finishing processes. Considers smooth running gears from the point of view of the theoretical designer.

24-101. **Designing of "Trouble-Free" Dies.** C. W. Hinman *Modern Industrial Press*, v. 7, Oct. '45, pp. 24, 40.

Butt-welding technique; economy in butt-welding; butt-flash welding machines.

24-102. **Convair's New Three-Dimensional Positioners.** Thomas A. Dickinson. *Modern Industrial Press*, v. 7, Oct. '45, pp. 32, 34, 36, 38, 40.

Facilitates assembly tooling by simplifying and speeding the work of finding extremely accurate three-dimensional locations.

24-103. **Sheet Metal Stamping—Principles of Design.** Wallace C. Mills. *Product Engineering*, v. 16, Nov. '45, pp. 756-757.

Line drawings and captions presented to show ways in which different methods of manufacturing affect product design. Principles and practical limitations are illustrated.

24-104. **Layout Reproduction the Loftec Way.** *Aviation*, v. 44, Nov. '45, p. 135.

For high-gear output of P-47's, a quick, simple, and accurate reproduction process was essential—and so Republic devised this master luminous-paint-coated metal negative unit.

24-105. **How Stress Measurements Aid Crankshaft Design.** S. Oldberg and C. Lipson. *Machine Design*, v. 17, Nov. '45, pp. 127-132.

Rational approach to the design of a machine element subject to such complex loading as a crankshaft necessarily involves experience, calculation and experiment. Eval-

uates these methods of approach and discusses some design problems that were solved through laboratory tests.

24-106. **The Design of Accurate Live Tailstock Rams and Running Centers.** F. M. Birch and J. Lunzer. *Machinery* (London), v. 67, Oct. 11, '45, pp. 405-408.

Principles of design; importance of continuous loading; difficulties due to skewing.

24-107. **Selection of Cooling Coils.** George K. Marshall. *Heating & Ventilating,* v. 42, Nov. '45, pp. 82-87.

Method of calculation and selection of cooling coils for various applications.

24-108. **Design of Taper and Parallel-Shank Running Centers.** F. M. Birch and J. Lunzer. *Machinery* (London), v. 67, Oct. 18, '45, pp. 435-437.

Outlines design of running centers suitable for the following classes of work: General work to commercial limits; high-production and heavy work to commercial limits and general form-tool work on capstans; light work, at high speed, to fine limits; high-production and heavy work with interrupted cuts, to fine limits, using tipped tools; accurate, heavy, or high-production and form-tool work on capstans and turrets; accurate, heavy, or high-production and form-tool work to fine limits.

24-109. **A Package Sealer, Part 4.** Egmont Arens. *Die Casting,* v. 3, Nov. '45, pp. 30-32, 51, 52.

New model package sealer exemplifies "styling" in a die cast design which is in marked contrast to the old model where this feature was not considered.

24-110. **Do's and Don'ts in Die Casting Design. Part 2.** *Die Casting,* v. 3, Nov. '45, pp. 55-57.

Good and bad practice in respect to fillets.

24-111. **Exhaust Valve Has Special Design and Manufacturing Features.** Warren H. Carhart. *Steel Processing,* v. 31, Nov. '45, pp. 687-690.

Method developed by Thompson Products, Inc., at its West Coast plant at Bell, Calif., results in a two-piece forged and flash-welded valve.

24-112. **Simple Method for Computing Peripheral Clearance Angles on Internal Forming Tools.** William D. Rodney. *Screw Machine Engineering,* v. 7, Nov. '45, p. 76.

Formula given.

24-113. **Design of Tools and Fixtures.** *Machinery,* v. 52, Nov. '45, pp. 179-182.

Fixture for milling face-cam profiles; milling fixture for airplane parts; die equipped with three tool bits for notching flanged shell; counterboring obstructed holes.

24-114. **Limitations and Design of Precision Press Forgings.** *Product Engineering,* v. 16, Dec. '45, pp. 821-823.

Precision press forgings are of three types: extrusion forgings, impression die forgings and coin forgings. Methods of fabrication and tolerances as they affect design of forgings described in detail.

24-115. **Sheet Metal Forming—Principles of Design.** Wallace C. Mills. *Product Engineering,* v. 16, Dec. '45, pp. 854-855.

Principles and practical limitations of metal forming show how different methods of manufacturing may affect product design.

24-116. **Helical Steel Springs.** Carl P. Nachod. *Product Engineering,* v. 16, Dec. '45, p. 892.

Chart used in designing springs made from wire sizes ranging from 0.2 to 0.75 in. diameter.

24-117. **How Tangent Bender Tucks Flange Metal.** L. B. Green. *Machine Design,* v. 17, Dec. '45, pp. 101-106.

Discusses various features of machine, and factors leading to its development reviewed, indicating design problems encountered and how they were solved.

24-118. **Redesigning? Consider Materials Changes.** Richard K. Lotz. *Machine Design,* v. 17, Dec. '45, pp. 127-129.

Careful reappraisal of materials and production processes results in effective cost savings, and also serves to improve machine parts.

24-119. **Production Processes—Their Influence on Design, Part VI. Stamping.** Roger W. Bolz. *Machine Design,* v. 17, Dec. '45, pp. 131-136.

Covers shallow drawing, forming, punching, blanking, piercing, perforating, lancing, embossing, coining, swaging, shaving, trimming.

24-120. **How to Effect Economy with Die Castings.** S. E. Maxon. *Machine Design,* v. 17, Dec. '45, pp. 143-146.

Integral rivets simplify assembly; cast threads extend to shoulder; cored holes may have many shapes; multiple dies provide economy.

24-121. **Developing Parts for Production.** G. W. Birdsall. *Steel,* v. 117, Dec. 17, '45, pp. 104-108, 110, 150, 152, 154, 156, 158.

Brittle lacquer method of stress analysis helps to short circuit much expensive and time-consuming testing required by older methods, thus permits developing new and improved machine parts much faster. Twenty years' development now telescoped into single year.

24-122. **Transparent Templets From Plastic Sheets.** Phil Glanzer. *Modern Machine Shop,* v. 18, Dec. '45, pp. 192, 194, 196, 200, 202.

Uses and manner of handling them discussed. Has speeded airplane assembly and helped to reduce cost considerably.

SECTION XXV

MISCELLANEOUS

25-1. **The Organization of Experimental Research.** W. G. Radley. *Engineering,* v. 158, Nov. 24, '44, pp. 416-417.

The materials of the future will appear, mostly, as the logical end products of experiments carried out to obtain fundamental knowledge of the relationship between the atomic and molecular structure of materials on the one hand, and their electrical and mechanical properties on the other.

25-2. **Power Circuit Breakers.** H. F. Hentschel and E. W. Boehne. *Iron & Steel Engineer,* v. 21, Dec. '44, pp. 74-82.

New types of breakers operate on advanced principles of circuit interruption, giving industry safe equipment which eliminates some application and maintenance problems.

25-3. **Applied Research.** H. R. Ricardo. *Aircraft Engineering,* v. 16, Nov. '44, pp. 324-325.

Emphasis on the importance of quality in research personnel as compared with lavish expenditure on equipment.

25-4. **The Organization of Experimental Research.** W. G. Radley. *Engineering,* v. 158, Dec. 8, '44, p. 445.

Stresses importance of interchange of manufacturing, operating and research activities. Comprehensive library and effective information service, essential features of any large research organization.

25-5. **Design of Post-War National Employment Services for Professional Engineers and Scientists.** W. H. Pitcher. *Canadian Chemistry & Process Industries,* v. 28, Dec. '44, pp. 815-817, 819.

British plan; relationship to other government employment offices; special considerations from the standpoint of the national economy.

25-6. **Engineers of Tomorrow.** Robert M. Gates. *Mechanical Engineering,* v. 67, Jan. '45, pp. 5-8, 69.

Our leadership in engineering education; broader views of engineers' responsibilities; proposals for redirection and expansion of engineering education.

25-7. **Mass Production Line Tooled for Flexibility.** *Tool Engineer,* v. 15, Jan. '45, pp. 78-88.

Connecting rods and rod caps; plant layout; crankshaft line; camshaft line.

25-8. **Organize for Efficient Production.** Joseph V. Kielb. *Tool Engineer,* v. 15, Jan. '45, pp. 92-93.

A smooth production operation depends upon good organization. In turn, this demands a balanced division of responsibilities. Proposes an approach to the problem by defining the duties and inter-relationship of production engineering, production control, time study, and industrial relations.

25-9. **Alternating Current Control Systems for Overhead Cranes.** C. B. Risler. *Steel,* v. 116, Jan. 15, '45, pp. 104, 107, 108, 126, 128.

Because of the almost universal usage of alternating current, this discussion will be helpful in selecting controls and drives.

25-10. **Magnesium Fires Controlled With Sprinklers.** *Iron Age,* v. 155, Jan. 18, '45, p. 65.

Control of incipient fires; good housekeeping.

25-11. **Magnitogorsk at War.** V. Dudadevsky. *Iron & Steel,* v. 17, Dec. 7, '44, pp. 750-752.

Extension of the great Russian steelworks in the Urals.

25-12. **The Electronic Frequency Changer.** F. W. Cramer, L. W. Morton and A. G. Darling. *Iron & Steel Engineer,* v. 22, Jan. '45, pp. 52-67.

Useful tool now available for certain applications previously using other types of equipment. Describes an installation in daily use as an interconnection between 60-cycle and 25-cycle power systems.

25-13. **Aluminum Grommet Remover.** *Aero Digest,* v. 47, Dec. 15, '44, pp. 98-99.

By using the simple tool described, a fastener can be removed in approximately 20 sec. This is a tremendous time saving over older methods and the tool will do the job with little trouble, leaving no scars on the structure.

25-14. **Industrial Diamonds.** P. Grodzinski. *Aircraft Production,* v. 7, Jan. '45, pp. 3-6.

Properties and selection for special purposes. (Abstract from a lecture presented to Imperial College Chemical Society, South Kensington, Nov. 3, '44.)

25-15. **Scanning the Field for Ideas.** *Machine Design,* v. 17, Jan. '45, pp. 103-106.

Electronic timing; gear cutting; spindle drive; pneumatic charger, hermetically sealed relay; induction coils, changing of engines on attack bombers.

25-16. **Efficient Tool Control System Curbs Waste in War Production.** *American Machinist,* v. 89, Jan. 4, '45, pp. 83-86.

Survey at General Motors plant established a four-hour tool replacement schedule, minimized idle time at machines, and led to a sound tool-sharpening plan.

25-17. **Welding, Heat Treating, Cleaning and Finishing.** *American Machinist,* v. 89, Jan. 18, '45, pp. 311-327.

32nd annual review of welders, accessories, furnaces,

heaters, temperature control, polishing, cleaning, finishing.

25-18. **Metal Marking.** John E. Hyler. *Steel,* v. 116, Feb. 5, '45, pp. 120-122, 124, 126, 158, 160, 162, 164.

Functions of printing, engraving, stamping, embossing, electrical marking and other kinds of scribing obtainable in diverse and highly specialized machines for metal marking.

25-19. **Modern Development of Production Control.** Franklin S. Atwater. *Production Engineering & Management,* v. 15, Feb. '45, pp. 104, 106, 108, 200, 202.

Broader concepts of production control point to efficient coordination of men, materials and machines. Principles outlined here—involving every production factor from planning operations to materials handling to inspection—are suggested for practical application throughout the entire shop.

25-20. **Backbone of Engineering.** *Scientific American,* v. 172, Feb. '45, pp. 95-97.

Continuing development of metals and alloys is giving the mechanical engineer new tools with which to work. What metallurgy is doing now will have a direct effect on the progress that will be made in the future. New materials mean better machines and prime movers.

25-21. **Developments and Trends in Fabrication and Treatment.** *Metals and Alloys,* v. 21, Jan. '45, pp. 114-133.

Passing parade of broad developments in the whole field of materials processing. Individual methods and processes include rolling, forging, machining, heat treatment, welding, cleaning, finishing.

25-22. **The Principles of Mechanical Handling.** J. V. Smith. *Foundry Trade Journal,* v. 75, Jan. 18, '45, pp. 45-48.

Obtaining maximum results from plant laid down for post-war production. 2 ref.

25-23. **Metal Marking.** John E. Hyler. *Steel,* v. 116, Feb. 12, '45, pp. 98-100, 130, 132, 134.

Equipment and small tools available for scribing, etching, stamping or printing metals is augmented by metal-writing pencils, crayons, layout dopes and paints for hot or cold marking. 17 ref.

25-24. **Industrial Research.** W. C. Devereux. *Metal Industry,* v. 66, Jan. 19, '45, pp. 36-38.

Industrial research has in the past few years become of increasing importance; it will be an essential factor in the maintenance of post-war industry. 1 ref.

25-25. **Organizing Knowledge of Materials.** B. C. Boulton. *Product Engineering,* v. 16, Feb. '45, pp. 73-78.

Presenting a method of organizing industry's information on old and new materials into factual data to meet engineering demands based on progress. Concrete suggestions are cited in an effort to crystallize thinking on the subject and to curtail the duplication of effort in various laboratories.

25-26. **Employee Selection in the Metallurgical Industry.** *Wire and Wire Products,* v. 20, Feb. '45, pp. 128-131, 150.

Job evaluation and determination of the physical and psychological characteristics.

25-27. **General Production Control System.** B. G. L. Jackman. *Sheet Metal Industries,* v. 21, Feb. '45, pp. 283-291.

Material batching, size of batches, build specification, works orders.

25-28. **Materials Handling.** R. W. Mallick. *Machine Tool Blue Book,* v. 41, March '45, pp. 199-200, 202, 204, 206, 208.

Materials handling today still constitutes the greatest single item of labor cost in most industries, and yet the engineering effort put forth to solve this problem is not in direct proportion to the effort expended in other fields.

25-29. **Material and Process Selection.** E. P. Strothman. *Iron Age,* v. 155, March 1, '45, pp. 40-46.

Metal selection for a given end-product is not always simple or apparent. Production methods often are of more importance than physical properties of the metal or its price. One excellent example of this, herein, is the substitution of steel for magnesium in the B-29 nose frame. (Paper presented originally before the S.A.E. in Detroit.)

25-30. **Metals in War and Peace.** T. A. Solberg. American Society of Naval Engineers *Journal,* v. 57, Feb. '45, pp. 56-64.

Under the stimulus of this war, the scientific universe has been tremendously expanded. Fronts in the fields of medical science, metallurgy and electronics have pushed forward no less rapidly than our fronts in the field of battle.

25-31. **Selective Fits Are Easily Specified If Simple Instructions Are Followed.** John Gaillard. *American Machinist,* v. 89, March 1, '45, pp. 108-111.

If the shop cannot work to hole and shaft tolerances on prints, or their cost is excessive, the use of selective fits will allow larger manufacturing tolerances which are split in several zones. In general, selective fits must be designed to suit each case. By compiling basic information for such cases, companies can set up tables of selective fits for their various products.

25-32. **Two Aircraft Engines Built on One Assembly Line.** *American Machinist,* v. 89, March 1, '45, pp. 106-107.

Chevrolet's car-assembly lines turned out many sorts of body types and equipment options; the same scheduling methods control flow of subassemblies and parts for assembly of P. & W. engines.

25-33. **Truck-Tow Conveyors.** *Steel,* v. 116, March 12, '45, pp. 124, 170, 172.

Answer to difficult job of intra-plant handling.

25-34. **Plant Layout, Materials Handling.** R. W. Mallick. *Industry & Power,* v. 48, March '45, pp. 66-67.

Engineering efforts must be intensified to solve the problems of efficient plant layout and economical materials handling.

25-35. **An American Metallurgical Survey.** *Chemical Age*, v. 52, Feb. 3, '45, pp. 126-127.

Summary of results of survey of wartime engineering achievements, conducted by *Metals & Alloys*. Light metals; National Emergency steels; foundry industry changes; centrifugal casting; powder metallurgy; miscellaneous developments.

25-36. **Better Handling for Lower Costs Now and Post-War.** Harvey C. Erdman. *Factory Management and Maintenance*, v. 103, March '45, pp. 105-108.

Carefully planned materials handling system, operated with a minimum of manpower, has made it possible for the National Screw & Mfg. Co., Cleveland, to meet the tremendously increased demands for fasteners by war industries without losing sight of costs. Five separate conveyor systems, power trucks and tractors, and overhead cranes supply the answer to the company's problem for efficiently handling more than 175,000 pounds of fasteners daily.

25-37. **The Young Engineer in Foundry Production.** C. L. Heater. American Foundrymen's Association *Transactions*, v. 52, June '45, pp. 1293-1299, 1305-1310.

Opportunities of the foundry industry; what the foundry industry has to offer young engineers; selection of men.

25-38. **The Place of the Engineer in the Foundry.** L. J. Fletcher. American Foundrymen's Association *Transactions*, v. 52, June '45, pp. 1300-1304.

Art, craft and science; science in agriculture; foundry training; foundry work classified; applied science in the foundry; development of the engineer in the foundry.

25-39. **Processing and Packaging.** Walter J. Brooking. *Steel*, v. 116, April 9, '45, pp. 133, 136, 156, 158-162.

Need for better protection from corrosive elements and effects of rough handling during war brings revolutionary changes in materials and procedures for preservation and preparation of parts to be shipped and stored. Packaging developments demonstrate that it is possible for parts so treated to retain full serviceability in nearly all parts of the world and under all conditions.

25-40. **The Coinage Metals in Antiquity, III.** Douglas Rennie Hudson. *Metallurgia*, v. 31, Feb. '45, pp. 201-206.

A critical review of metal extraction and craftsmanship since the third millennium B. C. under the heads: Asia Minor, Phoenicia; South Russia.

25-41. **High-Temperature Gas-Turbine Power Plants.** J. S. Haverstick and A. M. G. Moody. *Mechanical Engineering*, v. 67, April '45, pp. 229-233.

Air-cooling gas turbine blades; evaluating thermal efficiency; other improvements with cooling; assump-

tions made for calculations; specific heat values. 12 ref.

25-42. **Material-Handling Aids in Modern Production.** Carl H. Moeller. *Mechanical Engineering,* v. 67, April '45, pp. 235-237.

Industrial truck is playing an important role in war production because of its ready ability to pick up and haul heavy loads, to stack one load upon another, to operate in congested areas, to load and unload freight cars, etc., and all at minimum operating cost with a low initial investment when compared with the savings effected.

25-43. **Removing Broken Tools From Drilled Holes.** *Machinery,* v. 51, April '45, pp. 200–202.

Makes an electric arc butt-weld between a stainless-steel welding rod and the broken part and then extracts the broken part by tapping with a hammer on a lathe dog or clamp secured to the welding rod. Shows a variety of drills, reamers, and pilots removed by the method described.

25-44. **Bits and Pieces.** *Metal Progress,* v. 47, March '45, pp. 508-510, 627.

Quenching oils. Lead foil as base for next to last step in metallographic polishing. Mounts for fine wire and thin sheet. Why did it sprout? Brazing keys into shafting. Identification of nickel alloys by spot tests.

25-45. **Chemical Products From Metal Works.** A. G. Arend. *Chemical Age,* v. 52, April 7, '45, pp. 309-312.

Potential post-war developments. Demand for metal salts; lead and tin products.

25-46. **Forecasting Aircraft Propulsion.** Colin Carmichael. *Machine Design,* v. 17, April '45, pp. 103-108.

Recent engineering trends discussed, and the significance of new developments such as the gas turbine, jet propulsion and rocket propulsion, as well as the conventional engine-propeller arrangement, will be evaluated in terms of their suitability in particular fields of application.

25-47. **Tricky Problems in Materials Handling.** Wilbur G. Hudson. *Industry & Power,* v. 48, May '45, pp. 61-63.

Unique, practical information is contained in this experienced engineer's description of how unusual problems in bulk materials handling were solved. Additional problems will be covered in a subsequent installment.

25-48. **Grading of Diamond Powder Approved Commercial Standard CS123-45.** *Wire & Wire Products,* v. 20, May '45, pp. 346-347, 350.

Purpose; scope; definitions; general requirements; detail requirements; methods of sampling and inspection; guarantee.

25-49. **Robot "Assemblers."** G. W. Birdsall. *Steel,* v. 116, May 14, '45, pp. 102-105, 136, 138.

Machine automatically positions nut on under side of assembly, feeds screw down through assembly, threads it into nut, tightens screw to any predetermined tension desired; drives any type head, all types of machine, sheet metal and self-tapping screws. Typical setup drives six screws in single assembly in 8 seconds, including time to unload and reload fixtures. Tensions up to 70 ft.-lb. are available for driving hardened cap screws.

25-50. **Fabrication and Treatment.** *Metals & Alloys*, v. 21, April '45, pp. 1080, 1082, 1084, 1086, 1088, 1090, 1092, 1094, 1096, 1098, 1100, 1102, 1104, 1106, 1108, 1110.

Machining, forging, forming, heat treating and heating, welding and joining, cleaning and finishing of solid materials. Methods, equipment, auxiliaries and control instruments for processing metals and nonmetals and for product fabrication.

25-51. **Centralized vs. Decentralized Aircraft Research Organizations, V.** K. R. Jackman. *Aviation*, v. 44, May '45, pp. 145-149, 250, 252.

Advantages and disadvantages encountered when research activities are organized in the "concentrated" form and the "separate-function" type of setup. Considers the work of specific governmental and industrial research organizations, citing the values afforded through cooperation of these agencies. 7 ref.

25-52. **Critical Points.** *Metal Progress*, v. 47, May '45, pp. 916-920.

Stainless steel sheet for easy welding. Crackless plasticity. Wanted: Tough steels, tough even when cold. Metallurgical versatility. Is there a ceiling? Bayer process for refining aluminum ore. Lime-sinter adjunct. Alumina from clay. Systematic studies of high temperature alloys. Speed the testing. Estimates of grain-boundary areas. Magical strain gages. Design 100% and work to very limits. Three locomotives every day. High speed—really *high* speed.

25-53. **Easy Internal Transport.** *Production and Engineering Bulletin*, v. 4, April '45, pp. 115-120.

Trucks and hand-drawn stackers designed for numerous purposes aid the efficient handling of work, tools and plant.

25-54. **Power Trucks.** E. C. Cook. *Steel*, v. 116, May 21, '45, pp. 112-114, 144, 146, 148, 150.

Contributing more to plant outputs by virtue of their enlarged carrying capacity and greater power. Special designs and attachments also increase their usefulness.

25-55. **Production Drawings Prove Helpful in Assembling Precision Parts.** William Lawrence Lewis. *American Machinist*, v. 89, May 24, '45, pp. 112-115.

Illustrations bear specific data for assembly of small components at each work station. They are particularly useful for novices and assist experienced operators.

25-56. **Engineering Planning—Principles and Methods.** James E. Thompson. *Product Engineering,* v. 16, June '45, pp. 367-371.

Basic functions of coordination, planning, and scheduling discussed; typical examples of record forms.

25-57. **Increasing the Productivity of Research.** Paul E. Klopsteg. *Science,* v. 101, June 8, '45, pp. 569-575.

Need for enhancing and augmenting the results of effort devoted to research and for some ways of measuring the output. Explores means for accomplishing this purpose.

25-58. **Integrated Materials and Methods Control.** Gerald E. Stedman. *Metals and Alloys,* v. 21, May '45, pp. 1302-1308.

Smart engineering in a metal working plant inevitably involves a close tie-in between the selection of materials and the processing methods used for its products. System for controlling and coordinating its materials and methods is responsible for the quality and efficiency of its output and is a worthy model for other metal-working plants to follow.

25-59. **Engineering Shop Notes.** *Metals and Alloys,* v. 21, May '45, pp. 1363-1364, 1366.

Scheduling slide rule. Resistance welded round corners. Diamond hones used on carbide tools. Preparing cast iron for silver brazing. Spot identification of stainless steels.

25-60. **Mechanism for Producing Speed Change by Reversing the Driving Shaft.** K. L. *Machinery* (London), v. 66, April 26, '45, pp. 455-456.

Mechanism is employed on a machine for fabricating a twisted-wire product. Wire is twisted in one direction for a specified number of turns at a given pitch, and then twisted in the reverse direction for a number of turns at a greater pitch.

25-61. **Tolerances for Screw Threads.** J. Butler. *Engineers' Digest* (American Edition), v. 2, May '45, pp. 249-254.

Requirements analysed and tables presented from which allowances may be calculated according to the shrinkage rate of the material to be used, the thread needed, and the degree of fit required. Three schemes of tolerances—fine, medium and coarse—proposed.

25-62. **Paint Materials.** Louis Montgomery. *Industrial Finishing,* v. 21, May '45, pp. 45-46, 48, 50.

Notes on receiving, storing, checking, testing, preparing, and controlling paint materials.

25-63. **Spray Booth Fires.** Peter P. Wood. *Industrial Finishing,* v. 21, May '45, pp. 80, 82, 84.

Causes of spray booth fires, where to position and how to fix the sprinkler heads, what causes spontaneous combustion fires, what to do to keep spray booths safe.

25-64. **The Organization of Metallurgical Research.** Richard Seligman. Institute of Metals *Journal,* v. 71, April '45, pp. 149-164.

Appeal for the formation of an all-embracing Metallurgical Council.

25-65. **Collection and Control of Magnesium Dust and Fumes, II.** O. E. Fenn. *Industrial Heating,* v. 12, June '45, pp. 1007-1008, 1010.

Discusses requirements of dust-collecting systems, and safety precautions and disposal of collected dust.

25-66. **Economical Power Distribution for Medium-Size Industrial Plants.** D. L. Beeman. *Steel,* v. 116, June 18, '45, pp. 116, 118, 160, 162.

Installations formerly believed to deliver most economical power for motors, controls, and other apparatus by using 2400 volts have increased efficiency with 4160 volts.

25-67. **Simplified Working Drawings.** *Production and Engineering Bulletin,* v. 4, May '45, pp. 183-186.

Breaking down production into simple operations carried a step further by supplying each operator with an elementary drawing showing clearly only information relating to the operation he performs.

25-68. **Force and Shrink Fits.** William Knight. *Machine Design,* v. 17, June '45, pp. 145-148.

Strength; commercial fits and tolerances; centrifugal forces.

25-69. **Thin Stock Accurately Marked By High-Speed Equipment.** Donald D. Morton. *American Machinist,* v. 89, June 21, '45, pp. 91-94.

Part numbers are steel stamped to close tolerances for depth by an air-operated machine, which requires only two simple adjustments when a new setup is needed.

25-70. **Perishable Tools on the Firing Line.** W. A. Johnson. *Tool Engineer,* v. 14, May '45, pp. 24-27.

Selection of proper tools for each job assures maximum tool life—pointers on salvaging or reworking worn tools.

25-71. **Demagnetizers—What They Accomplish.** Charles D. Briggs. *Tool & Die Journal,* v. 11, June '45, p. 108.

To rid the work of residual magnetism an external rotating magnetic field "shakes up" the ions. Two methods: (1) A constant d.c. field is rotated mechanically; (2) a strong a.c. field is used. Iron in the presence of an a.c. field presents many problems so a.c. demagnetizers must be specially designed to compensate for hysteresis losses.

25-72. **Dyeing Metal Parts for Identification.** R. P. Cole. *Tool & Die Journal,* v. 11, June '45, pp. 125, 130.

Dyeing of metal surfaces not practical for use on wearing surfaces. Colors intended only for identification during assembly.

25-73. **Fire Safeguards for Magnesium.** Robert S. Moulton. *Aluminum and Magnesium,* v. 1, June '45, pp. 20-21, 24, 28-29.

Magnesium incendiary bombs; fundamentals of fire safety; magnesium dust; machining operations; stor-

age; fire extinguishment; tests by Chicago Fire Department.

25-74. **Metallurgical Research.** *Metal Industry,* v. 66, June 8, '45, p. 361.

Organization by committee or individual effort?

25-75. **Automobile Handling Methods Speed Aircraft Engine Production.** George E. Stringfellow. *Steel,* v. 117, July 2, '45, pp. 104, 107, 112.

Handles interdepartmental movement of parts in unit loads on skids and pallets; moves loads by rail and highway to and from subcontractors without breaking bulk.

25-76. **Keltic Metal Work and Manuscript Illumination.** Douglas Rennie Hudson. *Metallurgia,* v. 32, May '45, pp. 9-13.

Correlation of red dot decoration in manuscript illumination and cloisonne enamelling; the Ardagh chalice; the Shrine of St. Dimma's gospels; Evangelia Quatuor of Lindau.

25-77. **Pointers on Marking Metals and Plastics.** H. O. Bates. *American Machinist,* v. 89, July 5, '45, pp. 126-127.

Marking suitable identification data on machines and equipment is an important manufacturing consideration. Outlines the marking characteristics of different materials and includes a chart on pressure requirements.

25-78. **Technical Research Must Continue to Insure National Security.** R. E. Larkin. *Product Engineering,* v. 16, July '45, pp. 433-437.

Coordinated scientific research for postwar military defense is discussed. Activities of the Wilson and Woodrum committees, and different opinions regarding the form such a program should take, are reported.

25-79. **Color Code for Bar Stock.** Benjamin Melnitsky. *Iron Age,* v. 156, July 12, '45, pp. 56-60.

Differences in plant requirements and practices make impossible the drafting of specific color codes. States the principles of metals grouping and color selection that apply generally. Stamping and other supplementary means of identification also described.

25-80. **Collection and Disposal of Magnesium Dust.** C. C. Hermann. *Foundry,* v. 73, July '45, pp. 90-91, 198, 200, 202.

Dust as produced in machining operations on magnesium castings, dust from grinding, polishing and buffing wheels working on magnesium castings either as a roughing operation in the cleaning room or as a finishing operation in the machining departments, also burring, filing and abrading operations considered.

25-81. **What Do You Think of Research?** G. H. McIntyre. *Enamelist,* v. 22, June '45, pp. 11-13, 46.

Symposium of opinion on science in industry.

25-82. **A Review of Coordinating Research Council Activities.** C. B. Veal. *SAE Journal,* v. 53, July '45, pp. 387-391.

Discussion of CRC outlines topically the content of its activity, touches upon the development of its organization, and illustrates two phases of its work, the formulation of test procedures and the impetus to the development of new products.

25-83. **Patenting An Invention.** Royal R. Rommel. *Wire & Wire Products,* v. 20, July '45, pp. 497-498, 517-518.
Gives to the average individual an outline of the nature of a patent right, and how to secure it.

25-84. **Adjustable Tube-Marking Fixture.** Alex S. Arnott. *Tool & Die Journal,* v. 11, July '45, pp. 104-108.
Fixture to perform the marking operation is illustrated.

25-85. **Automatic and Non-Automatic Machines Meet Varied Marking Requirements.** H. O. Bates. *American Machinist,* v. 89, July 19, '45, pp. 128-130.
Cylindrical, conical and odd-shaped parts require special marking devices and fixtures to meet mass production needs. These developments and other marking mthods are reviewed.

25-86. **Model War Plant.** *Steel,* v. 117, July 30, '45, pp. 82-87.
Points way toward greater efficiency in postwar manufacturing; network of conveyor systems; annealing offsets cold working; primer holes taper reamed; steel cleanliness essential.

25-87. **A Guide to Harmonious Collaboration Between Technical Service and Research.** Norman A. Shepard. *Chemical Industries,* v. 57, July '45, pp. 73-74.
Technical service and research are both necessary functions of a chemical company. Friction between them is not only unwarranted and unreasonable, but can be reduced if not avoided altogether, by observance of the precepts listed.

25-88. **Trade Names Index.** *Industrial Diamond Review,* v. 5, July '45, pp. 154-159.
Index of names used in the diamond tool and allied industries.

25-89. **Aeronautical Supremacy Demands Jet and Rocket Research, I.** Roy Healy. *Aviation,* v. 44, July '45, pp. 152-154.
Forecasting startling future developments, this rocket expert declares that for peace or for war unceasing work in this new field is vital if America is to maintain her place in the skies.

25-90. **Collecting Oil Mists Electrostatically.** A. H. Allen. *Steel,* v. 117, Aug. 6, '45, pp. 120-122.
Electrostatic dust precipitator with main ionizer-collector cell through which exhaust stream passes, and power pack at right to charge the collector. Shows how dust particles are given positive charge and then attracted to negatively charged collector plates.

25-91. **Eight Ways to Efficiency in Materials Handling.** *Production Engineering & Management,* v. 16, Aug. '45, pp. 101-102, 104.

Eight-way pallet, developed by the Naval Ordnance Materials Handling Laboratory, affords numerous and unusual handling advantages in palletized work.

25-92. **Production Machine and Tool Engineering.** *Production Engineering & Management,* v. 16, Aug. '45, pp. 110, 112.

Continuous surface process hardens shafts and tubing; cemented carbide dies cut shell nosing cost 80%; ingenious welding salvages cast aluminum parts; four-spindle drill press provides machine tool.

25-93. **Master Disks.** *American Machinist,* v. 89, Aug. 2, '45, p. 135.

Standard given, effective for production from Sept. 15, 1945.

25-94. **New Production Methods.** Arthur A. Schwartz. *Tool Engineer,* v. 15, Aug. '45, pp. 38-40.

Induction heating, new alloys, harder cutting tools, friction sawing, hot forming, powder metallurgy all portend great advances in postwar years.

25-95. **Scheduling Spare Parts.** A. H. Allen. *Steel,* v. 117, Aug. 20, '45, pp. 140, 142.

Special procurement system to coordinate handling of extra parts with regular production.

25-96. **Steel-Handling Innovations.** G. W. Birdsall. *Steel,* v. 117, Aug. 27, '45, pp. 108-109, 132, 134, 137.

Increased capacity of Chicago steel warehouse; ideas that can be utilized effectively to cut cost of steel storage, handling and processing in almost any plant.

25-97. **Some Technical Developments of the War and Their Effects in Peace.** Ralph E. Flanders. Franklin Institute *Journal,* v. 240, Aug. '45, pp. 75-82.

Wonders of science and engineering. Some of the horrors of science and engineering. Developments are the hopefully useful byproducts of an enormous undertaking on the part of civilization to commit suicide.

25-98. **Production of Ammonium Sulphate from Coke Oven Gas.** Frans Wethly. *Blast Furnace & Steel Plant,* v. 33, Aug. '45, pp. 976-980.

Saturator operation; production by the low-differential controlled crystal size process; production costs; producing a product which will meet future demands.

25-99. **Versatile Stowage With Eight Way Pallets.** Templeton Smith. *Iron Age,* v. 156, Aug. 30, '45, pp. 34-36.

Methods developed by the Naval Ordnance Materials Handling Laboratory for maneuvering an eight-way pallet with a fork truck provide a variety of space-saving stowage patterns not possible with the customary two-way pallet.

25-100. **A Metallurgical Inventory.** H. W. Gillett. *Mining & Metallurgy,* v. 26, Sept. '45, pp. 419-423.

Some of the things that have happened in the last 15 years.

25-101. **Turbosupercharger Production Details.** S. H. Brams. *Iron Age,* v. 156, Sept. 6, '45, pp. 88-93.

Interesting welding, precision casting, and design innovations devised to master the difficult job of quantity production of precision turbosuperchargers, which in turn has greatly aided in the manufacture of gas turbines for jet aircraft.

25-102. **Planning Your Finishing Room Conveyor System.** E. S. Davidson. *Industrial Finishing*, v. 21, Aug. '45, pp. 70, 72, 74.

Why some conveyor systems retard full efficiency; heat drying, air-circulating equipment inadequate; why another factory's conveyor won't fit your production; more factors you must consider in conveyor design.

25-103. **The British Iron and Steel Industry.** *Metallurgia*, v. 32, July '45, pp. 115-120.

Manufactures of the iron and steel industry are essential in peace and in war, but the change from peace to war conditions was not a simple operation, especially when it became evident that the flow of production would develop into a spate. Wartime achievements and some of the difficulties which were overcome in supplying the necessary weight of armor and other important accessories.

25-104. **Labor Saving Devices Speed Production and Reduce Costs.** John T. Smith. *Production Engineering & Management*, v. 16, Sept. '45, pp. 71-72.

New methods for material handling and fabricating that possess broad applicability.

25-105. **Streamlined Production of Anchor Chain.** *Production Engineering & Management*, v. 16, Sept. '45, pp. 78-89.

Arduous physical tasks have been eliminated and production density greatly increased by employing mechanical handling systems in this modern industrial plant.

25-106. **Collection and Control of Magnesium Dust and Fumes: Part III.** O. E. Fenn. *Industrial Heating*, v. 12, Aug. '45, pp. 1371-1373.

Discusses precipitating fluids, practices recommended for protection of operators of grinding stands and polishing jacks.

25-107. **German Fastener Industry Thirty Years Behind Times.** *Steel*, v. 117, Sept. 17, '45, pp. 122-123, 176, 178, 180, 182, 184, 186, 188, 190.

Report of American investigators, C. F. Newpher of National Screw & Mfg. Co. and R. H. Smith of Lamson & Sessions Co., indicates Nazi policy detrimental to progress in machines and techniques. Plentiful supply of cheap labor encouraged laissez-faire attitude. A few plants very progressive.

25-108. **Collection and Control of Magnesium Dust and Fumes: Part IV.** O. E. Fenn. *Industrial Heating*, v. 12, Sept. '45, pp. 1553-1554, 1556, 1558, 1560-1562.

Portable-tool and flexible-shaft grinding, cleaning with metallic abrasives, core spraying, shake-outs and smoke tunnels, pouring stations and melting rooms are covered.

25-109. **On Engineering Writing.** Donald M. Crawford. *Mechanical Engineering*, v. 67, Sept. '45, pp. 607-609.

Notes recognizing some weaknesses that are commonly found in manuscripts prepared by engineers.

25-110. **A Method of Production Control.** George D. White. *American Foundryman,* v. 8, Sept. '45, pp. 45-47.

Production problems, aggravated by the unprecedented demands of the war years, have been met in many plants by control systems designed for particular plant conditions and accorded the cooperation of management and operating divisions. When service and costs again become vital factors in postwar production, control of the manufacturing process will be even more important than it is today.

25-111. **Eight Ways to Greater Handling Efficiency.** *Steel,* v. 117, Sept. 24, '45, pp. 148, 150, 172, 174.

New 8-way pallet used by U. S. Navy's Bureau of Ordnance provides important increases in versatility and flexibility in handling and stowage, at same time reducing aisle space requirements and strengthening unit loads.

25-112. **In Search of Aluminum.** *Light Metals,* v. 8, Sept. '45, pp. 436-444, 445-447.

Being the record, with reflective commentary in lighter vein, of an unusual journey, made under somewhat awkward conditions, through territory turned inside out and upside down by war, and left high and dry by peace.

25-113. **Material Collection by Wet Separation.** *Sheet Metal Worker,* v. 36, Sept. '45, pp. 55-57.

Expanded field seen for removal of dust, fumes, paint collection, etc., by the wet principle.

25-114. **Jet Bomber Armament.** R. A. Averitt. *General Electric Review,* v. 48, Oct. '45, pp. 51-55.

Greater speeds and greater power characterizing these airplanes necessitate a new approach to the armament problem. Jet-propelled airplanes; growth of defensive armament; a specific airplane; turrets; sights; computers.

25-115. **Applied Research.** Harry R. Ricardo. Institution of Mechanical Engineers *Journal,* v. 152, Sept. '45, pp. 143-148.

Instrumentation; research and industry; design; invention; research laboratories.

25-116. **Films Tell Story of New Techniques.** *Production Engineering & Management,* v. 16, Oct. '45, pp. 108, 110, 205.

Industrial movies graphically describe advances made in use of new engineering materials and new methods of economically shaping and assembling as America turns to output of civilian goods.

25-117. **Mass Production Layout for Manufacture of Rocket Projectiles.** W. G. Miller. *Steel Processing,* v. 31, Sept. '45, pp. 563-566.

Materials handling and metal working techniques.

25-118. **Government Support of Research.** Vannevar Bush. *Product Engineering,* v. 16, Oct. '45, pp. 649-652.

Five basic principles to be followed in the organization and operation of proposed agency.

25-119. **Layout of Experimental Gas Turbine Unit.** R. A. Riester. *Blast Furnace & Steel Plant,* v. 33, Oct. '45, pp. 1274-1276.

Air for turbine; efficiencies; turbine temperatures.

25-120. **The Facts About Atomic Energy.** A. H. Allen. *Steel,* v. 117, Oct. 1, '45, pp. 112-114, 148, 150, 152, 154, 156, 158, 160, 162.

Strange behavior; speed is complication; neutrons and protons; chain reaction; DSM project; materials $44,000 a ton; low-cost method; control by slots; atomic power? —yes, but at a price; plutonium a mystery; grams from tons; shielding against radiation; unequal fission masses; a $2,000,000,000 gamble; gaseous diffusion; barriers are a problem; huge steam plants; electromagnetic separation; separation by thermal diffusion; chain reaction hinges on critical size.

25-121. **Maintenance and Repair of Lifting Magnets.** V. E. Holtslander. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 65-69.

Presenting a number of practices that have resulted in longer and more efficient magnet service.

25-122. **Steel Plant Maintenance.** D. S. McLean. *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 75-78.

Successful maintenance requires thorough training of personnel, regular inspection and reports, intelligent management of spares, advance planning of jobs, and close cooperation with operating and engineering departments.

25-123. **Maintenance Symposium.** *Iron & Steel Engineer,* v. 22, Sept. '45, pp. 79-89, 91.

Maintenance; mechanical maintenance in steam-electric generating stations; electrical maintenance; instruments in the steel industry; lubricants in maintenance; maintenance of flow meters.

25-124. **Standardized and Simplified Handling.** George E. Stringfellow. *Steel,* v. 117, Oct. 22, '45, pp. 106-107, 144, 146.

Exceptionally efficient handling methods take care of movement in processing huge quantity and variety of materials. Program is developed for effective plant layout to promote ease and safety in handling operations.

25-125. **Tomorrow Is Today for the Magnesium Industry.** Edw. S. Christiansen. *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 21, 51.

Employment opportunities will gradually be offered to thousands of workers, and our standard of living will eventually be raised through the introduction of many labor and energy-saving applications for magnesium. (Address delivered at Second Annual Meeting of the Magnesium Association.)

25-126. **Aspects of Magnesium That Invite Investigation.** Anthony Cristello. *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 23, 40-41.

Fire hazard in machining; surface treatments for magnesium; new alloys.

25-127. **Metallurgical Progress.** L. Sanderson. *Mine & Quarry Engineering,* v. 10, Oct. '45, pp. 252-254.

Various interesting developments in metallurgical field summarized.

25-128. **Aircraft Engine Metallurgy Since World War I.** Walter E. Jominy. *Steel,* v. 117, Nov. 5, '45, pp. 128-129, 192, 194, 196, 198-199.

Materials discussed are magnesium, sodium, silver, lead plate, indium plate, beryllium, stainless steel, columbium, titanium, selenium, chromium plate, sintered bushings, sintered carbides, molybdenum high speed steel, nitralloy steel, forged aluminum, heat treated aluminum castings and high temperature alloys. Processes or tests discussed are nitriding, grain size control, development of S-curves and hardenability testing, induction hardening, magnaflux testing, furnace atmosphere control, hydrogen brazing, hardness testing with Rockwell machines, shot blasting, and quantitative spectrography.

25-129. **Steel Strapping Method.** *Steel,* v. 117, Nov. 5, '45, pp. 135, 172, 174, 176.

Developed by Navy materials handling laboratory for safeguarding ordnance materials against rough wartime handling; it is equally suited to many industrial packing problems.

25-130. **Versatile All-Steel Conveyor.** *Steel,* v. 117, Nov. 5, '45, p. 147.

Employs novel method of linking steel plates.

25-131. **Report on Wartime Electronic Developments.** *Electronics,* v. 18, Nov. '45, pp. 92-93.

Describes electronic systems, equipment and components developed during the war.

25-132. **Dielectric Heating Fundamentals.** Douglas Venable. *Electronics,* v. 18, Nov. '45, pp. 120-124.

Power requirements, thermal losses, characteristics of the load, and types of networks for matching the load to the oscillator are discussed.

25-133. **A Workable System for Developing New Products, I.** Ralph F. Bisbee. *Finish,* v. 2, Nov. '45, pp. 18-21, 54.

Presenting a product development system that has worked successfully for both wartime and peacetime products. Includes a description of the system from the earliest inception of a product idea to final testing of its shipping characteristics.

25-134. **German Metallurgy.** *Automobile Engineer,* v. 35, Oct. '45, pp. 398-400.

Some wartime specifications in automobile construction. Position with regard to critical metals briefly reviewed. Methods adopted for conserving critical materials are discussed. They include strict enforcement of scrap segregation and the development of chromium-manganese and chromium-silicon steels to provide hardenability without any excessive use of the ferro-alloys in shortest supply. Complete analyses are given for the steels used in several important components.

25-135. **"Canning" Ordnance in Aluminum.** W. Wade Moss. *Light Metal Age,* v. 3, Oct. '45, pp. 21-26, 34.

Describes the background and development of aluminum balanced pressure barrier. Factors which led to the selection of aluminum, details of the "breather", construction and handling of the "can", and the possible civilian adaptations of this development.

25-136. **British Metallurgical Research Associations.** *Metallurgia,* v. 32, Sept. '45, pp. 213-223.

Gradually it is being appreciated that, to maintain a progressive position, British industry must make a steady and persistent study of the many problems that continuously arise. The rapid growth has created difficulties for the staffs of the majority of individual works' laboratories and a partial solution has been sought in cooperative research.

25-137. **The Coinage Metals in Antiquity, Part IV.** Douglas Rennie Hudson. *Metallurgia,* v. 32, Sept. '45, pp. 229-236.

A critical historical review of process metallurgy in the rich copper and bronze Mediterranean culture, and of accomplished Aegean craftsmanship in gold working.

25-138. **X-Ray's Golden Jubilee—1895-1945.** David Goodman. *Metal Progress,* v. 48, Nov. '45, pp. 1096-1098.

History of discovery of X-rays by Roentgen, and subsequent progress.

25-139. **The Development of Atomic Energy.** Andrew W. Kramer. *Power Plant Engineering,* v. 49, Oct. '45, pp. 95-100.

Neutron escape; critical size; reduction of non-fission capture by isotope separation; control of the chain reaction; the possibility of using plutonium; availability of materials; power vs. the atomic bomb.

25-140. **Car Production Principles as Applied to Aircraft.** B. G. L. Jackman. *Sheet Metal Industries,* v. 22, Oct. '45, pp. 1769-1772.

Protective finishes; spot welding; time study; type of labor; production costs and maintenance.

25-141. **Scientific Research in Australia.** *Engineering,* v. 160, Oct. 5, '45, p. 264.

Covers standards laboratory, measuring equipment, radio and electrical studies, optical problems.

25-142. **Scientific Research in Australia.** *Engineering,* v. 160, Oct. 12, '45, pp. 283-284.

Covers synthetic jewels, aeronautical and engine research, wear, lubrication and bearing studies, thermal fatigue.

25-143. **Scientific Research in Australia.** *Engineering,* v. 160, Oct. 19, '45, pp. 314-315.

Covers lubrication and frictional studies, chemical and metallurgical treatment and minerals, corrosion studies, metallurgical studies, plastic and synthetic resin research.

25-144. **Slat Conveyors and Elevators, V.** *Production & Engineering Bulletin,* v. 4, Sept.-Oct. '45, pp. 361-365.

Slats of wood or metal are linked together and form a flexible conveyor band that is capable of withstanding heavy loading and rough usage.

25-145. **Industrial Research Pattern of the United States.** Harold Vagtborg. *Chemical and Engineering News,* v. 23, Nov. 10, '45, pp. 1943-1945, 2055.

A survey of research establishments and their organization including those of companies, associations, institutes, foundations, universities, and the federal government.

25-146. **Handling Materials With Lifting, Tiering and Special Trucks.** *Chemical & Metallurgical Engineering,* v. 52, Nov. '45, pp. 119-130.

Developments in equipment. Techniques extremely far reaching, particularly in package simplification, in reduction in ship and freight car turn-around time, and in production of unitized loads for shipment without manual re-handling.

25-147. **A Chronology of Wire and Wire Products.** Compiled by F. R. Morral. *Wire & Wire Products,* v. 20, Nov. '45, pp. 862-866, 885, 886, 887.

Represents research work which delved into French, German and English magazines and publications as well as American sources.

25-148. **Transfer Crane System.** G. W. Birdsall. *Steel,* v. 117, Nov. 19, '45, pp. 124-126, 144, 147.

Mechanical handling aids are correlated with plant layout and processing work to greatly facilitate wide range of manufacturing operations.

25-149. **Compressed Air.** *Steel,* v. 117, Nov. 19, '45, p. 128.

Devices aid in speeding up loading and handling.

25-150. **Plutonium.** *Metal Industry,* v. 67, Nov. 9, '45, p. 305.

Development and operation of chain-reacting piles. 1 ref.

25-151. **Research for Small Business.** D. H. Killeffer. *Scientific American,* v. 173, Dec. '45, pp. 346-348.

Research into effective means of utilizing reasearch reveals that small businesses can put themselves on a par with big business by making use of available facilities.

25-152. **Economics of Electronics.** Keith Henney. *Scientific American,* v. 173, Dec. '45, pp. 349-351.

Much of the enthusiastic but misguided publicity given to electronics may prove a boomerang to acceptance of really worthwhile developments. Uses of electronics, especially in manufacturing techniques, are almost unlimited, but require careful and responsible development.

25-153. **How to Install and Maintain Electronic Controls, Part 2.** H. L. Palmer. *Factory Management & Maintenance,* v. 103, Dec. '45, pp. 152-154.

Considers methods used in checking and testing such equipment.

25-154. **A Metallurgical Study of German Aircraft Engine and Airframe Parts. Section III. Connecting Rods. IV. Gudgeon Pins and Wrist Pins.** *Metallurgia,* v. 32, Oct. '45, pp. 263-269.

Summarizes reports of examinations of connecting rods, gudgeon and wrist pins.

25-155. **The Coinage Metals in Antiquity, Part V. Aegean and Offshoot Cultures; Cloisonné.** Douglas Rennie Hudson. *Metallurgia,* v. 32, Oct. '45, pp. 273-280.

A critical review of the growth of metal working in Aegean and offshoot cultures.

25-156. **Layout Reproduction System.** *Steel,* v. 117, Nov. 26, '45, pp. 96-98.

High accuracy, direct contact negatives and prints produced without camera or projector.

25-157. **Atomic Power and Atomic Bombs.** Ralph P. Johnson. *Metal Progress,* v. 48, Dec. '45, pp. 1313-1344.
Condensation of the "Smyth Report", particularly the metallurgical considerations; a new oath for engineers; the official declaration about atomic energy.

25-158. **Metallurgical Research.** T. R. Wright. *Mining & Metallurgy,* v. 26, Nov. '45, pp. 559-560.
General description of the Cerro de Pasco Copper Corp.'s metallurgical laboratories and research problems.

25-159. **Useful Tables for Sheet Metal Men.** Eric Steiner. *Sheet Metal Worker,* v. 36, Nov. '45, pp. 56-57.
Table showing inches expressed in decimals of a foot; circle, circumference and area table decimals and equivalent fractions.

25-160. **Cooperative Research.** Ernest A. Schoefer. *Corrosion & Material Protection,* v. 2, Dec. '45, pp. 6-8, 12.
Review of the Alloy Casting Institute Program conducted at Battelle Memorial Institute.

25-161. **Twin Production Lines.** W. G. Miller. *Steel,* v. 117, Dec. 10, '45, pp. 120-121, 174, 176, 178.
Naval Ordnance plant at Canton achieved remarkable output through special tooling and efficient handling arrangements.

25-162. **A Workable System for Developing New Products, Part II.** Ralph F. Bisbee. *Finish,* v. 2, Dec. '45, pp. 22-24.
Proving tests; transportation tests; inspection; customer use tests; standardization of quality control for porcelain enameling.

25-163. **Improving Car Shop Facilities.** *Railway Mechanical Engineer,* v. 119, Dec. '45, pp. 580-584.
Material handling; fabrication and reclamation by welding; best wheel shop practices.

25-164. **Long Loads.** *Steel,* v. 117, Dec. 17, '45, pp. 120, 122.
Problems encountered in handling long steel channels, bar stock tubing, sheet and similar materials may be surmounted by use of a power truck, a hand truck, and a few simple fixtures.

SECTION XXVI

STATISTICS

26-1. **Steel Industry Faces Adjustment Problems.** J. D. Knox. *Steel,* v. 116, Jan. 1, '45, pp. 194-197.

Scrapping of uneconomical open-hearth furnaces expected after war. Intensive sales effort needed to keep electric furnace capacity occupied. Study being given methods of beneficiating low-grade ores. Part of cost of many new basic metal plants probably can be charged off to cost of making war.

26-2. **Automobiles.** A. H. Allen. *Steel,* v. 116, Jan. 1, '45, pp. 198-199.

Automotive industry faces reconversion task of first magnitude, but management has advantage of experience gained in switching over to annual new models.

26-3. **Shipbuilding.** W. J. Campbell. *Steel,* v. 116, Jan. 1, '45, pp. 202-203.

United States, with two-thirds of world's merchant ship tonnage, will cut back construction sharply after the war. Eight hundred thousand tons annually generally believed top figure for postwar years. Disposal of surplus vessels and yards poses large problem.

26-4. **Agriculture.** Erle F. Ross. *Steel,* v. 116, Jan. 1, '45, pp. 204-205.

Farm machinery industry expected to start at end of European war on a several-year period of sharply expanded production, exploration of new markets for new products, and extremely keen competition. Reconversion will be relatively easy because prewar facilities are intact.

26-5. **Railroads.** Erle F. Ross. *Steel,* v. 116, Jan. 1, '45, pp. 206-207.

Carriers hope to receive sufficient steel to make overdue improvements and modernization during 1945. Wartime service has been outstanding despite shortages of equipment. Past year's freight traffic has been double 1940; passenger travel four times 1940 load.

26-6. **Containers.** L. E. Browne. *Steel,* v. 116, Jan. 1, '45, pp. 208-209.

Tin plate production expected to increase during 1945, but must await end of war and freeing of Straits supply of tin before output attains prewar levels. Sub-

stitutes necessitated by war unlikely to be retained when coating metal again becomes available in quantity.

26-7. **Appliances.** R. L. Hartford. *Steel,* v. 116, Jan. 1, '45, pp. 210-211.

Home appliance industry, completely converted to war production, faces difficult task in resuming civilian output. Many new companies will enter field. Postwar costs, particularly labor, are expected to be higher.

26-8. **Construction.** L. E. Browne. *Steel,* v. 116, Jan. 1, '45, pp. 212-213.

Huge construction volume awaits relaxation of wartime controls on manpower and materials. Need seen for million residential units yearly. Structural steel fabricators wondering to what extent tremendous advance in wartime welding can be utilized in postwar economy. Engineers differ in opinions.

26-9. **Machine Tools.** Guy Hubbard. *Steel,* v. 116, Jan. 1, '45, pp. 214-215.

Disposition of excess machine tools at end of war is one of gravest problems facing builders. Government will own approximately 500,000 tools, of which 100,000 will be retained for security purposes, leaving 400,000 surplus.

26-10. **Machinery and Equipment.** Guy Hubbard. *Steel,* v. 116, Jan. 1, '45, pp. 216-217.

Some heavy metalworking equipment continues in "critical" category. Many long-standing traditions in design, construction and use have been brushed aside by war developments.

26-11. **British Steel Industry Looks Ahead to Peacetime.** J. A. Horton. *Steel,* v. 116, Jan. 1, '45, pp. 304-305, 353-355.

Peak of war production passed early in 1944. Change in steel's position indicated by drop in semifinished imports and exportation of plates. Wartime controls are expected to be relaxed gradually.

26-12. **Domestic Market Summary.** G. H. Manlove. *Steel,* v. 116, Jan. 1, '45, pp. 308-309, 347-348.

Steel output in 1944 sufficient to fill war demands. Regulation of production and delivery easier than in earlier war years. Numerous strikes and general manpower shortage prevented full utilization of expanded facilities.

26-13. **Steel, 1944.** Tom Campbell. *Iron Age,* v. 155, Jan. 4, '45, pp. 55-59.

After working itself into a comfortable mid-year position, the steel industry is again entering a period of schedule improvising, maintenance difficulties, delayed deliveries, sudden shifts in military requirements, and an impending series of labor demands.

26-14. **War Production.** Hiland G. Batcheller. *Iron Age,* v. 15, Jan. 4, '45, pp. 61-63, 196.

With 1945 now scheduled as a two-war year the available supplies of many essential war metals again

are critical. Extreme pressure on wire mill products is to be expected; and brass strip, rod, and tube requirements exceed available facilities and manpower.

26-15. **Non-Ferrous Metals.** Charles T. Post. *Iron Age,* v. 155, Jan. 4, '45, pp. 65-67, 184, 186, 188, 190, 192.

Germany's lost grip on stolen resources premonishes disaster. Meanwhile, as America suffers serious depletion of its rich reserves, the brakes are slammed on the bulk of current domestic production to avoid a stockpile avalanche that will depress postwar markets.

26-16. **Transportation.** Jack R. Hight. *Iron Age,* v. 155, Jan. 4, '45, pp. 77-81, 180D-180F.

Railways continue to bear up under an unprecedented traffic load. Meanwhile, development trends in transportation—land, sea, and air—indicate a distinct trend toward simplified propulsive systems for more economical operation in the postwar era.

26-17. **Machine Tools.** Frank J. Oliver. *Iron Age,* v. 155, Jan. 4, '45, pp. 87-89, 180H, 193.

New demands for munitions plus Russian buying plus a rush for reconversion made machine tool orders take a second upturn at year's end. Reverses in Europe may end recent surge of unrated orders and discussions of surplus machine tool disposal problems.

26-18. **Foundry.** J. Albin. *Iron Age,* v. 155, Jan. 4, '45, pp. 91-95.

Mechanization, physical plant improvement, and testing and process control are the means by which foundrymen expect to secure a quality postwar product in competition with other practices and, at the same time, offset the dwindling pool of workers.

26-19. **Prices and Production.** John Anthony. *Iron Age,* v. 155, Jan. 4, '45, pp. 119-121, 148, 150, 152, 154, 158, 160, 162, 164, 166, 168, 170, 172.

The production of metal products has reached astounding peaks during the war but prices have been stabilized. However, open-hearth grades of scrap dropped below ceilings near the end of August, after which open market fluctuations have reflected supply and demand.

26-20. **Nickel Production in 1944 Less Than Last Year Because of Labor Shortage in Mines.** Robert C. Stanley. *Metals,* v. 15, Dec. '44, pp. 6-7.

Entire output of metal went into war material for the United Nations; steel industry continued to be largest consumer; post-war supply outlook is called favorable.

26-21. **Large Expansion Predicted in Electrolytic Tin Plate Use When Restrictions Are Ended.** J. C. Whetzel. *Metals,* v. 15, Dec. '44, pp. 12-14.

Process now accounts for one-quarter of entire output of tin plate and has saved 20,000,000 lbs. of metal.

26-22. **More Copper and Zinc Needed for Stepped up Munitions Program; WPB Tightens Hold on Lead.** *Metals,* v. 15, Dec. '44, pp. 18-20, 28.

FEA permits larger exports of bonded copper to South America; MRC stockpile of lead being greatly reduced.

26-23. **Gray Iron in the Postwar Period.** Donald J. Reese. *Foundry,* v. 73, Jan. '45, pp. 85, 220, 222, 224, 226.
Measures required of the foundry industry if it is to improve its competitive position after the war. (Paper presented before annual meeting of the Gray Iron Founders' Society.)

26-24. **West Awaits Decision on Future of War-Born Metalworking Capacity.** Robert Bottorff. *Steel,* v. 116, Jan. 8, '45, pp. 76-78.
New steel mills, scores of fabricating works, foundries and machinery plants raise hopes of westerners for industrial structure firmly established on heavy manufactures. Many market studies are under way.

26-25. **Developments in the Iron & Steel Industry During 1944.** W. H. Burr. *Iron & Steel Engineer,* v. 22, Jan. '45, pp. 80-92.
Material prepared by the A.I.S.E. Development Committee. Blast furnaces; steelmaking; rolling mills; finishing; furnaces and control; materials handling; mechanical developments; electrical developments.

26-26. **A History of the Iron and Steel Industry.** F. C. Farrell. *Iron & Steel Engineer,* v. 22, Jan. '45, pp. 99-104.
Evidence of the industry's influence on the industrial, economic, political, and social development of nations and of the world.

26-27. **Iron Ore in 1944.** M. D. Harbaugh. *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 69-76.
Scrap situation in relation to ore; the Lake Superior District; research activities; new developments on the ranges; Canadian Lake Superior operations; other districts; Southern and Western.

26-28. **Steel Production in 1944. W. O. Philbrook.** *Blast Furnace & Steel Plant,* v. 33, Jan. '45, pp. 119-126.
Production in 1944; electric furnace capacity; metallurgical developments; steelmaking practice; future trends. 5 ref.

26-29. **Tungsten Saga.** *Business Week,* Jan. 6, '45, pp. 28, 30, 32.
The industry in America has expanded threefold to meet war needs. New uses sought to maintain postwar demand.

26-30. **Sees Need of Reimposing Four-Cent Duty on Foreign Copper Brought into United States after War.** Louis S. Cates. *Metals,* v. 15, Jan. '45, pp. 6-7.
Would prevent dumping of cheaply produced metal on our market; stockpiling bill, loosely drawn, needs revision.

26-31. **Lead Enters 1945 as a Critical Commodity; Industry and Government-Owned Stocks Low.** Irwin H. Cornell. *Metals,* v. 15, Jan. '45, pp. 8-9.
Consumption will have to be cut; need of larger

imports raises question of adequacy of present price for foreign ore and metal; policy of exporting to allies also to fore.

26-32. **Aluminum to Remain in Forefront as Long as War Lasts; Many New Uses Found for Metal.** Arthur V. Davis. *Metals,* v. 15, Jan. '45, pp. 10-11.

United States output is at rate three times that of peacetime peak; large postwar civilian consumption anticipated.

26-33. **Manpower Shortage Looms as Big Problem for Zinc Production and Consumption during 1945.** Ernest V. Gent. *Metals,* v. 15, Jan. '45, pp. 12-15.

Output in 1944 fell below 1943 but consumption was higher; continued imports of concentrates necessary to meet needs.

26-34. **Stepping Up Ammunition Program in England Has Not Necessitated Larger Use of Copper.** L. H. Tarring. *Metals,* v. 15, Jan. '45, pp. 16-17.

Work confined to filling shell cases already in store; lead control in building trade lifted; zinc supply ample.

26-35. **War Production Board Down on Use of Metals Following Reverses on Western Front; Manpower Short.** *Metals,* v. 15, Jan. '45, pp. 18-21, 32.

Reconversion to peacetime goods halted; more foreign copper to be imported; lead supply tight, new curbs imposed.

26-36. **Copper Production in 1944.** *Mining Journal,* v. 28, Jan. 30, '45, pp. 9-10.

Primary production of copper at the end of 1944 was at the lowest level since the third quarter of 1939; declines ranging from 9 to 12% in outputs of domestic mine, smelter and refinery copper are recorded when 1944 figures are compared with the record production of 1943. Consumption also declined.

26-37. **Tin Plate.** J. R. Mahoney. *Western Metals,* v. 3, Jan. '45, pp. 16, 18.

Qualities, western markets and possible production at Geneva.

26-38. **Precious Metals in the Pacific Northwest.** H. H. Engle. *Western Metals,* v. 3, Jan. '45, p. 26.

Gold and silver production; unforseeable factors.

26-39. **Trend—As the Metallurgists See Light Metals.** D. Basch, J. D. Hanawalt, Paul P. Zeigler, E. W. Rouse, Walter Bonsack, I. W. Wilson. *Light Metal Age,* v. 3, Jan. '45, pp. 14-15, 36, 39.

Poll of representative leaders in the aluminum and magnesium industry, as to the position and potentialities of light metals for 1945 and the future.

26-40. **The Zinc Industry.** Arthur A. Center. *Mining & Metallurgy,* v. 26, Feb. '45, pp. 67-68.

New plants and improvements, here and abroad.

26-41. **Metallurgy of Copper.** Joseph Newton. *Mining & Metallurgy,* v. 26, Feb. '45, pp. 69-70.

Production still the problem, with metallurgical innovations few.

26-42. **Iron and Steel Process Metallurgy.** Michael Tenenbaum. *Mining and Metallurgy,* v. 26, Feb. '45, pp. 82-86.

Practice gradually returning to normal; improvements varied but minor.

26-43. **Base Metal Markets.** *Metal Industry,* v. 66, Jan. 5, '45, pp. 8-9.

Review of activities in 1944.

26-44. **Steel in the West.** *Fortune,* v. 31, Feb. '45, pp. 130-133, 258-261.

Pacific Coast industry is in full revolt against its steel differential. With the aid of two new plants built for war, it well may win its fight.

26-45. **Metal Production Figures for 1944.** *Mining Journal,* v. 28, Feb. 15, '45, pp. 6-12, 43-48.

Preliminary figures indicate that the mine production of gold, silver, copper, lead, and zinc, in the Western United States and Alaska in 1944, had a total value of $407,816,036, compared to $448,630,530 in 1943. Arizona continued as the leading copper producing state; Utah ranked first in gold output; and Idaho led all of the western states in the production of silver, lead, and zinc.

26-46. **Outlook for Magnesium Castings.** Ward Grantham. *Modern Metals,* v. 1, Feb. '45, pp. 22-23.

Future of magnesium.

26-47. **Gold.** *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 95, 96.

Outlook for stable gold industry more promising. Purchasing policies likely to stay unchanged. Foreign countries better supplied.

26-48. **Silver.** Humfrey Michell and Herbert M. Bratter. *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 97-99.

A discussion of silver with divergent views on the monetary aspect.

26-49. **Lead.** Alfred L. Ransome. *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 100-101.

High consumption eats into stocks as mine output declines.

26-50. **Copper.** H. H. Wanders. *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 101-103.

All-out for war as year ends. Consumption in 1945 expected to establish new high. Purchases from abroad to be larger.

26-51. **Zinc.** Evan Just. *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 103-104.

Production continued to outstrip consumption. Reserve supply at year-end substantial. Conservation order eased by War Production Board.

26-52. **Tin.** H. H. Wanders. *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 104-105.

Supply outlook for 1945 expected to show little change. Strict conservation to continue until production increases.

26-53. **Minor Metals.** *Engineering and Mining Journal,* v. 146, Feb. '45, p. 105.

Good markets for group provided by expanding demand for military and essential civilian requirements.

26-54. **Ferro-Alloys.** Edwin Jenckes. *Engineering and Mining Journal,* v. 146, Feb. '45, p. 109.

The emphasis is no longer on vanadium, tungsten, and molybdenum. Alloy steel now easier; industry cooperation cited.

26-55. **Minor Metals Livest Topic in Non-Ferrous Metallurgy.** Carle R. Hayward. *Engineering and Mining Journal,* v. 146, Feb. '45, pp. 123-125.

Urgency for full production inhibited advances in metallurgy of major metals, but indium, calcium, lithium, and others have found important uses and quantity production of them seems a possibility. High vacuum techniques studied.

26-56. **The Future of Aluminum.** *Metal Industry,* v. 66, Feb. 9, '45, pp. 82-84.

Plea for more informative publicity on the post-war prospects of aluminum and its alloys. It is suggested that a reduction in the number of alloy compositions would be of great benefit to the designer.

26-57. **The Past and Future of Steel.** C. H. Desch. *British Steelmaker,* v. 11, Feb. '45, pp. 52-58.

Damascus swords; puddled iron; crucible process; bessemer process; open-hearth process; electric furnace; direct reduction process; ore beneficiation; sintering.

26-58. **Sees Tight Copper Supply Situation in '45 Unless Domestic Production Is Increased.** F. H. Hayes. *Metals,* v. 15, Feb. '45, pp. 5-7, 14.

Mines need 4,000 additional workers to maintain present output of 73,000 tons monthly—larger imports will supply war needs.

26-59. **Over 90,000 Tons of Lead Needed per Month to Satisfy Needs of Consuming Industries.** Felix Edgar Wormser. *Metals,* v. 15, Feb. '45, pp. 8-10.

Domestic mines to supply 32,000 tons, scrap 30,000 tons, imports 20,000 tons; curtailment needed to save stockpile.

26-60. **North American Silver Production in 1944 Dropped Sharply; U. S. Holdings Also Down.** *Metals,* v. 15, Feb. '45, pp. 11-14.

Estimated decline was 11% for Mexico; 17% for U. S.; 20% for Canada; Peru's output reported unchanged.

26-61. **10-Year Stockpiling Program for Strategic Metals Urged by Army-Navy Munitions Board.** *Metals,* v. 15, Feb. '45, pp. 15-18.

Other developments in month include drop in output of copper, new lead restrictions; zinc to be allocated.

26-62. **British Producers Get Breathing Spell by U. S. Decision to Purchase Empire Copper.** L. H. Tarring. *Metals*, v. 15, Feb. '45, pp. 19-20.

Affords government and mining officials opportunity to plan for future disposal of Canadian and Rhodesian copper output.

26-63. **Copper Production.** F. H. Hayes. *Mining Congress Journal*, v. 31, Feb. '45, pp. 52-55.

Manpower losses are responsible for decrease in domestic production—imports have increased.

26-64. **Lead.** F. E. Wormser. *Mining Congress Journal*, v. 31, Feb. '45, pp. 56-58.

Government stockpile has dropped to less than one month's supply and WPB has ordered drastic cuts in certain uses of lead.

26-65. **Zinc.** Ernest V. Gent. *Mining Congress Journal*, v. 31, Feb. '45, pp. 59-62.

War program indicates heavier calls for zinc in 1945 in the face of reduced labor forces at mines and fabrication plants.

26-66. **Iron Ore.** M. D. Harbaugh. *Mining Congress Journal*, v. 31, Feb. '45, pp. 64-71.

Activity still high though below 1943. Optimism as to war's outcome caused some retardation in production but with change in picture this industry shows re-determination to furnish all the iron ore the country needs.

26-67. **Ferro-Alloy Metals.** E. Franklin Hatch. *Mining Congress Journal*, v. 31, Feb. '45, pp. 72-74.

Continuation of the present status of the ferro-alloy minerals and metals is indicated at least until a major change in war requirements takes place.

26-68. **Gold Mining Looks to the Postwar Era With Confidence.** Merrill E. Shoup. *Mining Congress Journal*, v. 31, Feb. '45, pp. 88-91.

While the gold industry of the United States and Alaska weathered another discouraging year, it faces the future with head unbowed if bloody, and looks forward to the brightest period in its history.

26-69. **Silver.** *Mining Congress Journal*, v. 31, Feb. '45, pp. 92-93.

We are in the midst of an unusual situation which results from a greatly decreased production of silver and a greatly increased demand for silver for industrial and monetary purposes. The increased industrial demand comes largely from war plants and the manufacturers of "non-essential" silverware and jewelry. The increased monetary demand is reflected largely in domestic coinage.

26-70. **Bauxite, Alumina and Aluminum Ingot.** Arthur B. Benefee. *Mining Congress Journal*, v. 31, Feb. '45, pp. 94-97.

By the end of the year the aluminum system had ample stocks of both raw materials and primary and secondary ingot and was operating considerably below its installed capacity.

26-71. **Magnesium.** Arthur Lowery. *Mining Congress Journal*, v. 31, Feb. '45, pp. 97-99.

Many new postwar uses are being forecast for this light metal which is at present well over the production hump.

26-72. **Antimony.** R. G. Hall. *Mining Congress Journal*, v. 31, Feb. '45, pp. 100-101.

Prospects for an increasing demand for antimony are good. Improved metallurgy producing an arsenic-free product will further widen the field.

26-73. **Quicksilver.** Gordon I. Gould. *Mining Congress Journal*, v. 31, Feb. '45, pp. 111-112.

Tariff policy, stockpiling program and new-use possibilities need clarification to bring confidence to domestic producers.

26-74. **Aluminum Prices.** H. F. James. *Metal Industry*, v. 66, Feb. 23, '45, pp. 116-117.

Past record of the aluminum producers guarantees favorable prospects for the consumer in the postwar period.

26-75. **Wartime Accomplishments of Our Metal Industry.** Clyde Williams. *Mining & Metallurgy*, v. 26, March '45, pp. 163-165.

Production and substitution problems successfully solved through cooperation.

26-76. **Canadian Steel.** *Western Metals*, v. 3, Feb. '45, pp. 28, 30, 32.

Dominion plants laying plans for postwar market.

26-77. **Canadian Steel Industry.** *Canadian Metals & Metallurgical Industries*, v. 8, March '45, pp. 38-39, 42.

Sound basis for the future maintained in wartime developments.

26-78. **Materials of Industry in Postwar Technology—Steel.** J. B. Austin. *Western Metals*, v. 3, March '45, p. 31.

Advantage will undoubtedly be taken of wartime metallurgical developments such as: Use of boron in steel to enhance hardenability; new knowledge, experience and steel compositions in connection with the use of steel at elevated temperatures; use of welding as a means of fabrication; continued use of some of the NE steels.

26-79. **British Steel.** Alexander Dunbar. *Iron and Steel*, v. 18, March '45, pp. 82-84.

Advocates the continuance of the system of private enterprise, subject to Government control, and points out the necessity of a sound organization of the industry and of its being prepared to place national efficiency before individual gain. The obligations of the industry, vis-a-vis the nation, the steel consumers, and the steelworks employees.

26-80. **Metal and Mineral Position of the United States and the Outlook for the Future.** Elmer W. Pehrson. *Metals,* v. 15, March '45, pp. 12-15.

Our country is neither "have-not" nation nor treasure-house of stored-up mineral wealth. Reserves compared with past production and with prewar consumption; mineral policy considerations.

26-81. **Magnesium and Postwar Small Business Prosperity.** *Die Casting,* v. 3, April '45, pp. 44-46, 56.

Postwar task; structural uses.

26-82. **The Future of the British Steel Industry.** Alexander Dunbar. *Metallurgia,* v. 31, Feb. '45, pp. 169-171.

Iron and steel industry is a basic industry upon which practically every other industry depends and it is one of the industries which will be expected to make the transitions from war to peace conditions in the least possible time. Reorganization and reconstruction plans must be given effect while endeavouring to maintain a high level of production. Future of such a vital industry is directly concerned with the economic future of Britain and all views which contribute to speeding the transition period are of great value. Brief survey of the steel industry.

26-83. **Swedish Iron Production After the First World War and Now.** *Teknisk Tidskrift,* v. 75, Jan. 13, '45, pp. 39-40. Iron and Steel Institute *Bulletin,* no. 111, March '45, p. 121-A.

The commercial aspects of the Swedish iron and steel industry in the 1920 and 1930 decades are compared and the problems with which it is likely to be faced at the end of the present war are discussed.

26-84. **Lead and Zinc Production in the Pacific Northwest.** N. H. Engle. *Western Metals,* v. 3, April '45, pp. 28, 31.

Statistics.

26-85. **Change in Tariff Would Injure Competitive Position of Domestic Producers of Copper.** Louis S. Cates. *Metals,* v. 15, April '45, pp. 6-7, 16.

Would result in extensive unemployment in mining areas; stockpiling will prevent mine shutdowns at end of war.

26-86. **Tin Stocks Low.** Fred W. Willard. *Metals,* v. 15, April '45, pp. 8, 14.

Detinning facilities available; problem of getting adequate scrap supply unsolved.

26-87. **Further Reductions in Import Duties Would Prove Harmful to Tri-State Zinc District.** F. F. Netzeband. *Metals,* v. 15, April '45, pp. 13-14.

Concessions granted to one country under reciprocal trade agreement become available to practically all others.

26-88. **Lord Geddes Defends Copper Cartel as Aid to Industry as Well as Market Stability.** L. H. Tarring. *Metals,* v. 15, April '45, pp. 15-16.

Says competition would have destroyed Rhodesian producers; favors giving government full information at all times.

26-89. **Approaching V-E Day Makes Metal Consumers Inventory Conscious; Purchases Restricted.** *Metals,* v. 15, April '45, pp. 17-21.

Copper and zinc deliveries to consumers in March set new high records; forward requirements anticipated.

26-90. **The Future of Our Mineral Production.** Carl H. Wilken. *Mines Magazine,* v. 35, March '45, pp. 119-122.

National income determined by raw material income; formula; raw material income affects national economy; effect of importation of raw materials; effect of sub-parity prices on national income; value of foreign trade; sound economy for United States; stabilized price level.

26-91. **Raw Materials and Foreign Policies of Nations.** Meherwan Cavasji Irani. *Mines Magazine,* v. 35, March '45, pp. 123-126, 136, 139.

International control of tin.

26-92. **Battle-Tested Aluminum.** David P. Reynolds. *Industrial Marketing,* v. 30, May '45, pp. 49-50, 58, 62.

What of the future?; knowledge of uses increasing; mines to be important users; transportation equipment profits from aluminum; marine equipment of aluminum; outstanding as packaging material; other uses.

26-93. **Prospects for Principal Cast Metals, Part 2.** Donald J. Reese. *Tool & Die Journal,* v. 11, May '45, pp. 107-109.

1943 and 1944 production for cast steel, gray iron, malleable iron, aluminum and magnesium.

26-94. **West Girds for Steel Fight.** *Western Metals,* v. 3, May '45, pp. 8-11.

Retention and development of iron and steel production in the West.

26-95. **Prospective Markets for Steel in New Western Fabricating Industries.** J. R. Mahoney. *Western Metals,* v. 3, May '45, pp. 18, 21-22.

Relation of new western steel mills to new industries; amount of steel used in products made.

26-96. **Zinc in the Pacific Northwest.** Fred Draper. *Mining World,* v. 7, May '45, pp. 20-23.

Tri-state output declining; importance of western ores; N. W. reduction capacity needed; retort vs. electrolysis; uses of "four-nines" metal; zinc plant by-products; postwar zinc prices.

26-97. **Materials Supply Outlook for Product Finishes.** Ed. H. Bucy. *Products Finishing,* v. 9, June '45, pp. 58-59, 62, 64, 66, 68.

The immediate situation; demands of the Pacific War; the materials situation analyzed; surplus stocks available; the postwar picture.

26-98. **Metals and Minerals in Post War Economy.** John D. Sullivan. *Mines Magazine,* v. 35, April '45, pp. 162-165, 181.

Effect of scrap in the postwar period on some of the more important metals. Comments briefly on aluminum and magnesium and on the world outlook on the supply of crude petroleum.

26-99. **Zinc-Reduced War Demands and Tariff Issue Obscure Outlook.** H. H. Wanders. *Engineering and Mining Journal,* v. 146, June '45, pp. 82-83.

That the domestic zinc producer gets excited when the subject of import duties is under discussion is understandable when the rates are examined and digested. The table was prepared by the American Zinc Institute and presented at the hearings on the bill for extending the Reciprocal Trade Agreements Act.

26-100. **War Production Board Reports on Steel Expansion for War.** *Steel,* v. 116, June 18, '45, pp. 98-106.

Details how ore, transportation, ferro-alloy, refractory, blast furnace, steelmaking, foundry, forging and other facilities were built up to supply huge requirements for war; steel industry faces no real conversion problem in transition from war to peace; data will be used in pending congressional hearings.

26-101. **The Post-War Outlook for the Base Metals.** Alan M. Bateman. *Western Miner,* v. 18, June '45, pp. 84, 86, 88, 90, 92.

It is now more difficult to foresee what may eventuate than after former crises, since this war has been so revolutionary with respect to the quantities involved and in the profound economic changes that have taken place in both producing and consuming countries. World flow of minerals cannot slip back into the old pre-war groove.

26-102. **Texas Steel.** Charles T. Post. *Iron Age,* v. 155, June 28, '45, pp. 58-66.

Growing southwestern market gains stability from Sheffield's integrated Houston works as model ore plant alone operates at DPC's frustrated Lone Star project.

26-103. **Domestic Chrome.** *Mining World,* v. 7, June '45, pp. 25-26.

Its abundance in the West may offer new industrial opportunities in the fields of electro-metallurgy and electro-chemistry.

26-104. **Some Problems in Base-Metal Reconversion.** G. C. Bateman. *Canadian Mining and Metallurgical Bulletin,* no. 398, June '45, pp. 362-368.

Problems to be faced in the reconversion period.

26-105. **Magnesium Poses Post-War Problems for United States Government and Industry, Part I.** *Metals,* v. 15, June '45, pp. 5-9.

Demand expected to be far less than in wartime—peacetime consumption placed at 65,000,000 lb. whereas country's productive capacity is estimated at close to 500,000,000 lb.

26-106. **Maintenance of Existing Duties on Metals Needed to Stimulate Industry in Post-War.** Julian D. Conover. *Metals,* v. 15, June '45, pp. 10-12.

Will restore confidence in future and offer incentive for prospecting and developing new mining properties.

26-107. **China Probing for Mineral Resources to Replace Those in Territory Lost to Japs.** Neville Whymant. *Metals,* v. 15, June '45, pp. 13-14.

Country's mineral wealth underestimated—can supply more tungsten, tin and antimony than needed for home use—may become important supplier of mercury to other countries.

26-108. **British Non-Ferrous Metals Control Board Removes Restrictions on Copper and Zinc.** L. H. Tarring. *Metals,* v. 15, June '45, pp. 15-16.

Permits applications for licenses without restrictions as to use to which metals will be put; export orders controlled.

26-109. **Domestic Metal Industry Interested in Subsidy Measure and Tariff Legislation.** *Metals,* v. 15, June '45, pp. 17-21, 26.

Premium price payments on copper, lead and zinc continued for one year; president gets power to cut tariffs by 50%.

26-110. **The Future of the Light Metal Industry in Britain.** D. D. Howat. *Mine & Quarry Engineering,* v. 10, June '45, pp. 133-138.

Production and consumption figures and methods.

26-111. **Wartime Metal Statistics.** *Metal Industry,* v. 66, June 22, '45, pp. 393-394.

Consumption figures for non-ferrous metals, 1942-1945.

26-112. **Raw Materials and Foreign Policies of Nations.** Meherwan Cavasji Irani. *Mines Magazine,* v. 35, May '45, pp. 215-223, 233.

International control of nickel.

26-113. **Preview of Alloy Steels in Postwar Western Industry.** Albert G. Zima. *Western Machinery & Steel World,* v. 36, June '45, pp. 254-257, 280.

Attempt to evaluate the postwar position of these new steels which were sometimes judged as non-uniform or unreliable. Preference was expressed for the NE 8600 and 8700 medium carbon grades for parts not requiring outstanding hardenability.

26-114. **Wartime Aluminum and Magnesium Production.** Hans A. Klagsbrunn. *Industrial & Engineering Chemistry* (Industrial Edition), v. 37, July '45, pp. 608-617.

Alumina production data; alumina production costs at government-owned plants; aluminum ingot facilities and production data for government-owned plants; average of aluminum production costs for nine months; aluminum ingot facilities and production data for privately owned plants; alumina facilities and production data; magnesium metal plants; freight rates on alumina

from plants to reduction centers; magnesium facilities and production data; lowest operating costs for electrolytic and ferrosilicon magnesium plants from Dec., 1943, to Oct., 1944.

26-115. **Metals and Fuels: The World Has Enough.** A. B. Parsons. Franklin Institute *Journal,* v. 239, June '45, pp. 437-444.

The notion that the world is going to "run out" of any essential mineral can be refuted. It overlooks significant facts as to the composition of the earth's crust; it ignores the lessons of experience; and it underestimates the imaginative ingenuity and the practical resourcefulness of scientists, of technologists, and of engineers. Geologic processes by which minerals are deposited in the ground are operative today. Metals can be and are salvaged for repeated use.

26-116. **The Postwar Outlook for Steel.** L. S. Hamaker. *Iron & Steel,* v. 18, June '45, pp. 182-185.

Considers the future of steel first in relation to possible competitors such as the light metals and plastics and then in relation to the demand for consumer goods which has piled up during the war—for houses, railways, agricultural implements, highways and the prospects in the export markets. Foresees Great Britain and the United States having between them to supply "an enormously expanded world demand for steel."

26-117. **The Future of Base Metals.** Edgar Pam. *Engineering,* v. 159, May 25, '45, p. 416.

Considers steps possible to increase production.

26-118. **Tin Restrictions Will Not Be Eased During Reconversion Owing to Mounting Scarcity.** *Metals,* v. 16, July '45, pp. 7-8, 23.

Available supplies dropped 70% since January 1942; more strict control in prospect; substitutes are available.

26-119. **Magnesium Poses Postwar Problems for United States Government and Industry. Part II.** *Metals,* v. 16, July '45, pp. 9-13.

Policy governing disposal of government-owned plants will be to stimulate competition among producers.

26-120. **British Ministry of Supply Relaxes Control over Copper; End-Use Need Not Be Specified.** L. H. Tarring. *Metals,* v. 16, July '45, pp. 15-16.

Government releases figures showing consumption of major non-ferrous metals for entire period of war.

26-121. **The Past and Future of Steel.** *Chemical Age,* v. 53 July 7, '45, Metallurgical Section, pp. 11-16.

Ancient history; eastern technique; bessemer and open hearth; chemical analysis; microscopic methods; Bell's experiments; the Thomas process; rust; protection methods; scrap surplus foreseen; drain on natural resources; large postwar needs; research in the future; trained technicians wanted.

26-122. **The Future of the Light Metal Industry in Britain.** D. D. Howat. *Mine & Quarry Engineering,* v. 10, July '45, pp. 159-165.

Progress and history in production and suggested problems to be pursued. 18 ref.

26-123. **The Future of the Light Metal Foundry Industry.** *Metallurgia,* v. 32, June '45, pp. 49-52.

Light alloy foundry achievements during the war; postwar use of plant and equipment; prices and future markets; alloys and alloy development; research and development.

26-124. **War-Time Consumption of Non-Ferrous Metals.** *Metallurgia,* v. 32, June '45, pp. 73-74, 79.

Ministry of Supply has released detailed figures of the consumption during the war years of the metals within the scope of the Non-Ferrous Metals Control; they deal with copper, zinc, lead, tin, nickel, cadmium, antimony, cobalt and manganese. A full breakdown into the main trades in which each metal was used is given for 1942 through the first quarter of 1945.

26-125. **More About Metals and Minerals in Postwar Economy.** John D. Sullivan. *Mining Congress Journal,* v. 31, July '45, pp. 34-38.

World outlook in metals and minerals, the effect of scrap on some important metals, and pertinent comments on aluminum, magnesium and petroleum.

26-126. **The Magnesium Industry in the United Kingdom.** H. W. Butterworth, T. W. Atkins and L. H. Davidson. *Modern Metals,* v. 1, Aug. '45, pp. 8-12.

Summary of the findings of a three-man mission from this country on the current developments in the production, fabrication and application of magnesium in the United Kingdom.

26-127. **Industry Estimates 1947 Markets.** *Iron Age,* v. 156, Aug. 23, '45, pp. 58-63.

Composite view of postwar markets for manufactured goods by American manufacturers themselves looks for an excellent first postwar year for both business and employment. Certain ifs, ands and buts lead to less encouraging possibilities but the probabilities are such as to urge business expansion.

26-128. **The Outlook for Electrolytic Tin Plate.** K. W. Brighton. *Iron & Steel Engineer,* v. 22, Aug. '45, pp. 37-39.

At present, wide variation in the corrosion resistance of electrolytic tin plate precludes its use for processed cans without enameling. The future of the electrolytic plate in this field depends on consistent production of a highly resistant plate.

26-129. **Tin—an American Problem.** R. Martinez Vargas. *Metals,* v. 16, Aug. '45, pp. 6-9, 17.

Tin is totally missing from the great pool of natural resources contained within the borders of the United States. For tin, there are no direct substitutes; the ore or the refined metal must be imported if the great industrial po-

tential of the United States is not to be completely disrupted. Current stocks limited; Bolivia ores vital; international accords.

26-130. **Magnesium Poses Postwar Problems for United States Government and Industry.** *Metals,* v. 16, Aug. '45, pp. 10-15.

Commercial use of metal will be far below wartime peak but new outlets being found; transportation and building offer vast opportunities for use of light metal alloys.

26-131. **British Metal Trade Urges Higher Price on Copper —Believes Minimum Should be £70.** L. H. Tarring. *Metals,* v. 16, Aug. '45, pp. 16-17.

Present level of £62 regarded as too low. Copper and zinc may be first two metals traded in on London 'change.

26-132. **A Program for Silver.** Perez Duarte. *Mining World,* v. 7, Aug. '45, pp. 36-38.

Suggestions and plans for the revival of silver.

26-133. **Aluminum in Japan.** *Metal Industry,* v. 67, Aug. 24, '45, pp. 121-123.

Deals with Japan's need of essential metals; gives an indication of the way in which she prepared for war and the problems which await those responsible for her deindustrialization.

26-134. **Uranium Supply Will Be Difficult to Control.** *Engineering & Mining Journal,* v. 145, Sept. '45, pp. 80-81.

Uranium is so widespread and abundant that we cannot depend on its scarcity to forestall the possibility of appalling destruction. It will be impossible to prevent a number of nations from obtaining it without our securing either their voluntary compliance or policing their internal activities.

26-135. **The Steel Trade in War.** Charles D. Rigg. *British Steelmaker,* v. 11, Sept. '45, pp. 388-390.

Great achievements under difficulties. Aluminum production in 1933 and 1938; Japan's resources; Mussolini's gamble; Britain's position; British empire steel ingot production; Axis steel ingot production.

26-136. **British Steel.** John A. Smeeton. *Iron and Steel,* v. 18, Aug. '45, pp. 373-374.

Post-war position of the industry.

26-137. **Reich's Steel Potential Still Large, Despite Bombing Damage.** George Reiss. *Steel,* v. 117, Sept. 24, '45, pp. 98-99, 201.

Half of capacity could be restored to production within three or four months. Only 30 to 35% needs complete rebuilding. Mills seldom were primary target of Allied planes. Transport system, supplying raw materials, badly wrecked.

26-138. **Magnesite and Other Magnesium Compounds in 1944.** *Refractories Journal,* v. 21, Aug. '45, pp. 320-325.

Statistics of the magnesite industry in the United States, 1941-44.

26-139. **The Future of Metals.** Robert S. Palmer. *Mines Magazine,* v. 35, Aug. '45, pp. 403-407.

High grade, low grade and potential ore; large mineral reserves; future for metal supply good; metal supply depends on price; reserve of manganese large; no cause for alarm at rate of mineral depletion.

26-140. **China's Steel Industry.** Henrik Ovesen. *Mechanical Engineering,* v. 67, Oct. '45, pp. 670-671.

Informal comments on the Nelson Mission and an expression of China's appreciation.

26-141. **Latin American Industrial Expansion Boosts Demands for Machine Tools.** J. Seward McCain and George Loinaz. *American Machinist,* v. 89, Sept. 27, '45, pp. 103-107.

Report on the condition of Latin America's metal-working industries; new steel plant; foundry shops scattered; tubing production small; new industries starting; technical training increases.

26-142. **The Progress of Magnesium and Its Alloys in Britain —1924-1945.** C. J. P. Ball. *Metallurgia,* v. 32, Aug. '45, pp. 153-159.

Magnesium is generally available on the earth's surface in the form of magnesite or magnesium carbonate in dolomite, of which latter there are enormous deposits in the British Isles. Since 1938, methods have been worked out and plants are in operation in Britain for leaching out magnesium oxide from dolomite by the use of sea-water so that magnesium metal and alloys have now become an all-British product.

26-143. **Dwindling Tin Supplies and the Problem of Reconversion Facing the United States. Part I.** *Metals,* v. 16, Sept. '45, pp. 6-9, 14.

War Production Board issues comprehensive survey of situation and concludes that control over consumption of metal must be continued.

26-144. **Canada's Metal Production, Stimulated by War Needs, Reached Unprecedented Levels.** *Metals,* v. 16, Sept. '45, pp. 10-14.

Country is greatest producer of nickel, asbestos, platinum and radium; second largest producer of gold, aluminum, mercury and molybdenum; third largest producer of copper, lead and zinc.

26-145. **London Metal Outlook Obscure Following Victory— Many Major Changes in Offing.** L. H. Tarring. *Metals,* v. 16, Sept. '45, pp. 15, 17.

Return to peace will affect consumption, allocation and distribution. Trade awaits government's new policies.

26-146. **OPA Retains Tight Grip on Metal Prices Whereas WPB Continues to Relax Controls.** *Metals,* v. 16, Sept. '45, pp. 18-21.

Truman favors stockpiling legislation; Senators suggest getting strategic metals abroad in return for loans; Italy seeks copper.

26-147. **What's New in Non-Ferrous Metals?** Archibald Black. *Machine Design,* v. 17, Oct. '45, pp. 129-132, 188, 190, 192.

Discusses only non-ferrous metal developments of the

last ten years and was inspired by appreciation of the necessity for knowing at least something about recent changes in the kaleidoscopic materials picture; aluminum; magnesium; beryllium; cemented carbide; porous chromium surfacing; die casting materials; silver bearings; laminated metals.

26-148. **Magnesium Industry Surveys Postwar Problems.** *Aluminum & Magnesium,* v. 2, Oct. '45, pp. 18-20, 55.
Problems on how to make the transition discussed at two-day session of the Magnesium Association's second annual meeting.

26-149. **Future of the British Light Alloy Foundry Industry.** W. C. Devereaux. *Foundry,* v. 73, Nov. '45, pp. 92-95, 146, 148, 151.
Some of the problems facing aluminum and magnesium foundries of the United States find their counterpart in this discussion of the outlook in the British light alloy foundry industry. Article is from the eighth Edward Williams Lecture, presented at the annual general meeting of the Institute of British Foundrymen.

26-150. **Lithium—Its War and Postwar Uses.** *Western Metals,* v. 3, Oct. '45, pp. 20-22.
Sources; discovery and development; lithium since World War I; size of industry; lithium in war industry; lithium in air-sea rescues; postwar uses.

26-151. **Wartime Supply and Consumption of Steel.** *British Steelmaker,* v. 11, Oct. '45, pp. 428-429.
Statistics relating to operations of the iron and steel industry during the War.

26-152. **The Steel Trade in War—Part II.** Charles D. Rigg. *British Steelmaker,* v. 11, Oct. '45, pp. 430-432.
Cartel imports; American and dominion imports; imported scrap; comparison with prewar production.

26-153. **1944 Rail Output Highest in 15 Years.** *Railway Engineering and Maintenance,* v. 4, Nov. '45, pp. 1127-1128.
Largely open-hearth steel.

26-154. **Tight Supply Situation in U. S. for Balance of Year Envisioned by WPB Lead Official.** John J. Croston. *Metals,* v. 16, Oct. '45, pp. 6-11.
Lead consumption running above supplies; at end of 1945 government will have 65,000 tons in stock.

26-155. **Dwindling Tin Supplies and the Problem of Reconversion Facing the United States.** *Metals,* v. 16, Oct. '45, pp. 12-15, 17.
WPB issues comprehensive survey of situation and concludes that control over consumption of metal must be continued.

26-156. **Copper and Zinc in Plentiful Supply for Reconversion; Tin and Lead Still Tight.** *Metals,* v. 16, Oct. '45, pp. 18-21, 29.
Krug says country well on way to solving postwar problems; trade ponders new metal stockpiling bill.

26-157. **British Steel in Wartime.** Eric N. Simons. *Canadian Metals and Metallurgical Industries,* v. 8, Nov. '45, p. 42.
How developments affect its future.

26-158. **Cast Iron Foundry Practice.** James S. Vanick. *American Foundryman,* v. 8, Nov. '45, pp. 57-67.
United States foundry industry adjusted to almost exclusive production of war castings and developed practices to meet greatly increased demands. (Paper presented before the French Foundry Technical Association.)

26-159. **The Battle of Steel—1. Steel at War.** *British Steelmaker,* v. 11, Nov. '45, pp. 472-480.
British iron and steel industry's wartime achievements. Deals with organization of the control, and general resumé of the problems it had to face.

26-160. **Post-War Steel Demands.** Charles D. Rigg. *British Steelmaker,* v. 11, Nov. '45, pp. 492-493.
U.S.A. production; requirements exceed production.

26-161. **Actual Dumping of Surplus Metals Would Do Less Harm Than Overhanging Threat of Sale.** Julian D. Conover. *Metals,* v. 16, Nov. '45, pp. 6-8, 21.
Mining industry seeks legislative safeguards to assure that stockpile of strategic metals will be inviolate.

26-162. **Metal Industry Expresses Views on Senate Bills for Stockpiling Strategic Metals.** *Metals,* v. 16, Nov. '45, pp. 9-10, 12.
Wants law carefully drawn to avoid possibility of having stockpile utilized as a political football.

26-163. **Domestic Lead Output Much Below Postwar Needs; Imports Needed to Augment Supply.** Felix E. Wormser. *Metals,* v. 16, Nov. '45, pp. 11-12.
Industry anxious to get back to free market as a means of remedying more quickly present situation.

26-164. **Text of Surplus Property Regulation 17 on the Stockpiling of Strategic Metals.** *Metals,* v. 16, Nov. '45, pp. 13-14.
Includes list of strategic minerals and metals and strategic materials.

26-165. **Steel Industry Statistics.** *Steel,* v. 117, Dec. 17, '45, 16-page insert following p. 76.
Include capacities by individual companies for production of pig iron, coke and steel ingots, as well as for finished products such as bars, plates, shapes, sheet, strip, tinplate, pipe, rails, car wheels and axles and bolts, nuts and rivets. Canadian statistics also reported.

SECTION XXVII

TECHNICAL BOOKS

of Interest to Metallurgical and Related Fields

27-1. **Vakuumtechnik in Laboratorium.** Günther Mönch. 218 pp., illus. (Glasenstrumentenkunde, v. 3). J. W. Edwards Brothers, Ann Arbor, Mich. $5.00.

27-2. **Vakuumspektroskopie.** Hans Bomke. 248 pp., illus. J. W. Edwards Brothers, Ann Arbor, Mich. $4.65.

27-3. **Elektrische Isolierstoffe; ihr Verhalten auf Grund der Ionenadsorption an Inneren Grenzflachen.** Paul Boning. 134 pp., illus. J. W. Edwards Brothers, Ann Arbor, Mich. $3.00.

27-4. **Die Metallurgie des Eisens.** Robert Durrer. 3rd ed., 1034 pp., illus. J. W. Edwards Brothers, Ann Arbor, Mich. $30.00.

27-5. **Optische Pyrometrie.** Fritz Hoffmann and Carl Tingwaldt. 134 pp., illus., J. W. Edwards Brothers, Ann Arbor, Mich. $3.60.

27-6. **Lehrbuch der Metallkunde; Chemie und Physik der Metalle und ihrer Legierungen.** Gustav Tammann. 4th ed., 536 pp., illus., J. W. Edwards Brothers, Ann Arbor, Mich. $12.00.

27-7. **Das Holz als Rohstoff; seine Entstehung, stoffiche Beschaffenheit und chemische Verwertung.** Rheinhard Trendelenburg. 435 pp., illus., J. W. Edwards Brothers, Ann Arbor, Mich. $7.75.

27-8. **Bauelemente des Flugzeuges.** Herbert Wagner. 2nd ed., 295 pp., illus., J. W. Edwards, Ann Arbor, Mich. $4.50.

27-9. **Die chemische Analyse in der Stahlindustrie.** Robert Weihrich. 3rd ed., 244 pp., illus. (Chemische Analyse, v. 31), J. W. Edwards Brothers, Ann Arbor, Mich. $7.25.

27-10. **Werkstoff Magnesium.** 2nd ed. 164 pp., illus., J. W. Edwards Brothers, Ann Arbor, Mich. $3.20.

27-11. **Hochfrequenz-Meistechnik.** Otto Zinke. 223 pp., illus. (Physik und Technik der Gegenwart; Abtlg.; Fernmeldetechnik, v. 3). J. W. Edwards Brothers, Ann Arbor, Mich. $6.20.

27-12. **The Aeronautical Dictionary.** Thomas A. Dickinson. 494 pp., illus., diagrs. Crowell Publishing Co., New York. $3.50.

Definitions of over 6000 terms in aerodynamics, meteorology, navigation, piloting, engineering, metallurgy, design, lofting, and aircraft construction. Some of the definitions are those of the National Advisory Committee for Aeronautics. Illustrated with photographs and with drawings by James D. Powell.

27-13. **Electrical Drafting Applied to Circuits and Wiring.** D. Walter Van Giesen. 148 pp., illus., diagrs., McGraw-Hill Book Co., New York. $1.50.

A textbook in drawing wiring plans, in terms of the finished electrical installation.

27-14. **Care and Use of Hand Tools.** Edited by William C. Lewis. Raymond R. Toliver. 100 pp., illus., diagrs., John Wiley & Sons, New York. $1.25.

A handbook for mechanics and students on how to handle and care for tools so they will last longer and give better service.

27-15. **Airframe Materials.** F. S. Stewart. 248 pp., illus., diagrs., McGraw-Hill Book Co., New York. $2.50.

An introductory textbook on the materials, metals, woods, plastics, that are used in the construction of airplanes.

27-16. **Questions and Answers for Airplane and Engine Mechanics.** Compiled and edited by Aviation Research Associates in cooperation with the technical staffs of the Academy of Aeronautics and the Casey Jones School of Aeronautics. 513 pp., illus., McGraw-Hill Book Co., New York. $4.00.

An aviation mechanic's guide in question and answer form, covering the aircraft maintenance and repair practice information which the student or apprentice mechanic must know to pass the Civil Aeronautics Administration examinations.

27-17. **Adsorption.** Charles Letnam Mantell. 394 pp., illus., diagrs., McGraw-Hill Book Co., New York. $4.50.

A correlation of the practical, commercial, and engineering aspects of adsorption.

27-18. **Production Engineering in the Aircraft Industry.** A. B. Berghell. 318 pp., diagrs., McGraw-Hill Book Co., New York. $3.00.

A textbook which is the outgrowth of courses on production engineering and aircraft statistics taught by the author under the Engineering, Science and Management War Training Programs at the University of Southern California and the University of California at Los Angeles.

27-19. **High-Frequency Induction Heating.** Frank W. Curtis. 243 pp. illus., diagrs., McGraw-Hill Book Co., New York. $2.75.

For the manufacturing executive and technician.

27-20. **Milling Machine Operations.** Lewis E. King. 132 pp., illus., diagrs., Macmillan Publishing Co., New York, Paper, $1.75.

27-21. **Production-Line Technique.** Richard Muther; foreword by Erwin Haskell Schell. 329 pp., illus., diagrs., McGraw-Hill Book Co., New York. $3.50.

The author made his observations first as an operator on various production lines, then as a technical staff assistant, and lastly as an analyst of a large number of production lines in Detroit and elsewhere.

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Suitable for a first course in mechanical vibrations for the engineering student who has a knowledge of mechanics and strength of materials and also to show the advanced student and practical engineer how problems of practical importance can be solved by relatively simple means.

27-23. **The Testing of High Speed Internal Combustion Engines.** Arthur W. Judge. 3rd ed., 462 pp., illus., D. Van Nostrand Co., New York. $16.00.

27-24. **Dictionary of Engineering and Machine Shop Terms.** A. H. Sandy. 153 pp., Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. $2.75.

Definitions in clear and simple language useful not only for engineers and students of engineering but also for foremen and specialized workmen.

27-25. **A Primer of Electronics.** Don P. Caverly. 235 pp., illus., McGraw-Hill Book Co., 330 West 42nd St., New York 18. $2.00.

Beginning with the atom, the electron, and static and electron discharges, goes step by step through explanation of electric current, magnetism, and electromagnetic radiation to an understanding of simple radio tubes, fluorescent lamps, cathode ray tubes, ignitron, thyratron, and other tubes and their basic connections for practical purposes.

27-26. **Aluminum—An Industrial Marketing Appraisal.** Nathanael H. Engle, Homer E. Gregory, and Robert Mosse. 480 pp., illus., Richard D. Irwin, Inc., 332 S. Michigan Ave., Chicago 4. $6.00.

An exhaustive report on the postwar outlook for aluminum. Factors of aluminum production; the aluminum industrial structure; aluminum markets; recommendations for public policy.

27-27. **Practical Design for Arc Welding, Volume 2.** Robert E. Kinkead. 100 welding design plates, The Hobart Brothers Co., Hobart Square, Troy 1, Ohio. $3.50.

100 design ideas with particular attention to fabrication of tubular members and connections. For use by designers, engineers and fabricators.

27-28. **New Methods for Sheet Metal Work.** W. Cookson. 207 pp., diagrs., 3rd ed., The Technical Press, Ltd., Gloucester Rd., Kingston Hill, Surrey, London, England.

A practical working textbook for apprentices, sheet metal workers, platers and draftsmen engaged in engineering, aircraft, shipbuilding and other industries.

27-29. **The Electronic Engineering Handbook.** Edited by Ralph R. Batcher and William Moulic. 456 pp., illus., diagr., Electronic Development Associates, 125 East 46th St., New York 17.

Fundamental principles of electronic design. A working reference for specialists in electron tube applications, particularly industrial phases rather than the communication field.

27-30. **Review of Iron & Steel Literature.** E. H. McClelland. *Blast Furnace & Steel Plant,* v. 33, Feb. '45, pp. 241-246.

Twenty-eighth annual review of iron and steel literature. Lists books and pamphlets published during 1944.

27-31. **Vakuumtechnik in Laboratorium.** Gunther Monch. 218 pp., illus. (Glasenstrumentenkunde, v. 3) J. W. Edwards, Ann Arbor, Mich. $5.00.

27-32. **Engineering Contracts and Specifications.** Robert W. Abbett. 195 pp., John Wiley & Sons, New York. $2.25.

Presentation of the legal and business aspects of the engineering profession.

27-33. **Aircraft Mechanical Drawing.** D. J. Davis and C. H. Goen. 259 pp., illus., diagrs. McGraw-Hill Book Co., New York. $2.50.

A course in the basic principles of mechanical drawing, a prerequisite to the study of detail drafting in aircraft engineering.

27-34. **Production Engineering in the Aircraft Industry.** A. B. Berghell. 318 pp., diagrs. McGraw-Hill Book Co., New York. $3.00.

A textbook which is the outgrowth of courses on production engineering and aircraft statistics taught by the author under the Engineering, Science and Management War Training Programs at the University of Southern California and the University of California at Los Angeles.

27-35. **Theory of X-Ray Diffraction in Crystals.** William H. Zachariasen. 225 pp., illus., John Wiley and Sons, New York. $4.00.

Both the theory of space lattices and their symmetry properties and the theory of X-ray diffraction in crystals are discussed in this advanced textbook for graduates of physics and chemistry. Higher mathematics is a prerequisite. Bibliographic references to additional material on crystal structure are included.

27-36. **American Malleable Iron—a Handbook.** 367 pp. illus., Malleable Founders' Society, Union Commerce Bldg., Cleveland 14, Ohio. $4.00.

Standard malleable iron and its properties, pearlitic; special and cupola malleable irons; malleable casting design; pattern design; machining practice; recommendations to users; manufacture and metallurgy of malleable iron; history; applications. Appendices cover specifications, protective coatings, bibliography, glossary, engineering tables and data.

27-37. **Handbook of Mineral Dressing; v. 1, Ores and Industrial Materials** (revision of Handbook of Ore Dressing). Arthur F. Taggart, editor. 1939 pp., John Wiley and Sons Publishing Co., New York, N. Y. $15.00.

27-38. **Manual of Aircraft Layout.** Rudolph Faltus and Charles Steinmetz. 214 pp., illus., John Wiley and Sons Publishing Co., New York, N. Y. $3.00.

Over-all picture of production with concise information on blueprint reading. Laying out jobs, template development, and machine and hand tools used in template construction. Charts and tables needed in calculations.

27-39. **Process Equipment Design.** Herman C. Hesse and J. Henry Rushton. 580 pp., illus., Van Nostrand, New York. $7.50.

Concerned primarily with design of equipment used in chemical industries. Basic information regarding mechanical properties and strength of materials, riveted and welded vessels, structural analysis, piping, design of gears, shafting and bearings, and handling equipment.

27-40. **Refrigeration and Air Conditioning Engineering.** B. F. Raber and F. W. Hutchinson. 291 pp., John Wiley and Sons Publishing Co., New York, N. Y. $4.00.

27-41. **Henley's Twentieth Century Book of Formulas, Processes and Trade Secrets.** Gardner Dexter Hiscox, editor. Revised and enlarged edition by T. O'Conor Sloane. 900 pp., illus., N. W. Henley, New York, N. Y. $4.00.

27-42. **An Introduction to Electronics.** Ralph G. Hudson. 97 pp., illus., MacMillan Publishing Co., New York. $3.00.

Written for the layman with only an elementary knowledge of electricity, physics and mathematics. Explains what is included in electronics and the part this new science is playing in the research and industrial world.

27-43. **Magnetochemistry.** Pierce W. Selwood. 298 pp., illus., Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. $5.00.

Measurement of magnetic susceptibilities; atomic diamagnetism; molecular diamagnetism; atomic paramagnetism; molecular paramagnetism; complex compounds; metallic dia- and paramagnetisms; ferromagnetism; applied magnetometric analysis.

27-44. **Industrial Electric Furnaces and Appliances, Vol. 1.** Victor A. Paschkis. 232 pp., illus., Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. $4.90.

Selection of furnace types; fundamentals of furnace calculations; fundamentals of furnace economy. Arc type and arc resistor type electrode melting furnaces. Special emphasis is placed upon the thermal aspects of furnace design and operation.

27-45. **Photomicrography.** 174 pp., illus., Eastman Kodak Co., Rochester 4, N. Y. $2.00.

A text that presents a simple discussion of the pertinent fundamentals of optics and photography as well as practical instruction in the technique of photomicrography.

27-46. **German-English Dictionary of Metallurgy.** T. E. R. Singer. 298 pp., McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. $4.00.

Intended for technical people using material in the fields of metallurgy, metallography, mining, mineralogy, crystallography and the working of metals.

27-47. **Metallkeramik; die Herstellung von Metallkorpern aus Metallpulvern, Sintermetallkunde und Metallpulverkunde;** third edition. Franz Skaupy. 250 pp. illus. J. W. Edwards Co., Ann Arbor, Mich. $4.80.

27-48. **Metalle und Legierungen fur hohe Temperaturen.** Werner Hessenbruch. 254 pp., illus. (Reine und angewandte Metallkunde, v. 2), J. W. Edwards Co., Ann Arbor, Mich. $8.75.

27-49. **Metall-Technisches Taschenbuch.** William Monot Guertler. 370 pp., illus. J. W. Edwards Co., Ann Arbor, Mich. $7.50.

27-50. **Werkstoff-Handbuch Stahl und Eisen; mit dem Werkstoffausschuss des Vereins Deutscher Eisenhuttenleute und Zahlreichen Fachgenossen Bearbeitet.** Karl Daeves. (Verein Deutscher Eisenhuttenleute.) Second ed. 320 pp., illus. J. W. Edwards Co., Ann Arbor, Mich. $13.50.

27-51. **Pulvermetallurgie und Sinterwerkstoffe.** Richard Kieffer and W. Hotop. 403 pp., illus. (Reine und angewandte Metallkunde, v. 9.) J. W. Edwards Co., Ann Arbor, Mich. $10.50.

27-52. **Dampfkesselschaden; ihre Ursachen, Vernutung und Nutzung fur die Weiterentwicklung.** Ernst Pfleiderer. 259 pp., illus. J. W. Edwards Co., Ann Arbor, Mich. $7.85.

27-53. **Elektrische Messung Mechanischer Grossen.** Paul Martin Pflier. Second ed. 259 pp., illus. J. W. Edwards Co., Ann Arbor, Mich. $6.50.

27-54. **Physik und Technik der Harte und Weiche.** Wilhelm Späth. 250 pp., illus., J. W. Edwards, Ann Arbor, Mich. $7.00.

27-55. **Transactions of American Society for Metals.** v. 34, 1945. Edited by Ray T. Bayless. 644 pp., illus., American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $5.00.

Twenty papers, with discussion, presented before the annual meeting of the Society in October 1944, plus the complete technical program, reports of officers, and the Campbell Memorial Lecture on "Some Fundamental Problems in the Manufacture of Steel by the Acid Open-Hearth Process" by G. R. Fitterer.

27-56. **Transactions of American Society for Metals.** v. 35, 1945, Edited by Ray T. Bayless. 638 pp., illus., Ameri-

can Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $5.00.

Twenty-two papers, with discussion, presented before the annual meeting of the Society in October 1944. Also three additional papers: "A New Metallographic Etchant for Aluminum Bronze and Copper-Beryllium Alloys" by W. C. Coons and D. J. Blickwede; "A Relationship Between Hardenability and Tensile Strength of Normalized Steels" by Louis A. Carapella; "Diffusion in Powdered Metals" by P. W. Selwood and Jane Nash.

27-57. **Principio to Wheeling; 1715-1945.** Earl Chapin May. 335 pp., illus., Harper & Brothers, 49 East 33rd St., New York 16, N. Y. $3.00.

Story of Principio Furnace, Maryland and how it became today's Wheeling Steel Corp. Story of the family of George Washington as iron masters and their descendants who were pioneers in developing our modern iron and steel industry.

27-58. **Electrical Essentials in Marine Service.** John M. Dodds. 428 pp., diagrs. (Marine Electricians' Library, v. 1) McGraw-Hill Book Co., New York, N. Y. $3.00.

The first of a projected series of three volumes on the fundamentals and principles of marine electricity, this covers essential principles of electricity and magnetism and the characteristics of electric circuits.

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A non-mathematical description of the physical basis for microwave phenomena. An excellent treatment for persons with some knowledge of fundamentals of electricity.

27-60. **English-Russian Technical Dictionary.** 674 pp., International University Press, New York. $10.00.

27-61. **Aircraft Armament.** Louis Bruchiss. Edited by Glenn D. Angle. 224 pp., illus., diagrs., Aerosphere Inc., 370 Lexington Ave., New York 17, N. Y. $6.00.

For the layman and the expert, a review of the field of aircraft armament; bombs, machine guns, cannon, ammunition, turrets, foreign aircraft weapons, armor protection, anti-aircraft weapons, self-propelled ammunition and bombs, and future weapons.

27-62. **Shrinkage and Gas Effects in the Casting of Non-Ferrous Metals and Alloys.** W. A. Baker. British Non-Ferrous Metals Research Association Report R.R.A. 661, June '44, 44 pp. Price 7s 6d.

Elementary discussion of unsoundness arising from solidification shrinkage or from evolution of dissolved gas. Practical hints for gating to control the one and degasification to control the other. Regulated gas evolution may be desirable to distribute solidification shrinkage. Correlates data from many separate investigations, references to 58 of which are given. Written in simple, relatively non-technical language.—H. W. Gillett.

27-63. **Damping Capacity: A General Survey of Existing Information.** F. C. Thompson. British Non-Ferrous Metals Research Association. Report R.R.A. 657, August '44, 37 pp. Price 3s 6d.

Intelligent correlation of present knowledge from both the engineering and the theoretical points of view. Damping behavior is more sensitive to minor changes in metallurgical history of a specimen than any other measurable property. It cannot be predicted by any other test and conversely it cannot be used to predict anything else, such as fatigue behavior. Qualitatively a high damping capacity is useful to the engineer as a means of helping to avoid build-up of resonant stresses. Qualitative measurements are intriguing, but the author doesn't claim that they have much practical application. Avenues through which more useful data might perhaps be found are pointed out.—H. W. Gillett.

27-64. **Rockets, Jets and Dynamotors.** A. L. Murphy. 170 pp., illus., Wetzel, Los Angeles, Calif. $2.50.

27-65. **Carbon Dioxide.** Elton L. Quinn and Charles L. Jones. Second Printing, American Chemical Society Monograph No. 72. 294 pp., illus., Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. $7.50

History, physical properties, chemical properties. Commercial manufacture of liquid and solid carbon dioxide. Uses of commercial carbon dioxide.

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Advanced text including material on dimensioning, machine sketching and machine details; drawing of bearings, shafting and couplings, jigs and fixtures, gears and cams, and piping.

27-67. **Rockets and Jets.** Herbert S. Zim. 326 pp., illus., Harcourt, Brace and Co., New York. $3.00.

Non-technical account of development of rockets and jet-propelled devices. Principles of jet propulsion; experiments with high altitude rockets; goals and problems of interplanetary rockets.

27-68. **Stress Relief of Weldments for Machining Stability.** J. R. Stitt. 47 pp., illus., paper, Engineering Experiment Station Bulletin No. 121, Ohio State University, Columbus, Ohio. $.50.

27-69. **Careers in the Steel Industry.** Burr W. Leyson. 191 pp., illus., Dutton Publishing Co. $2.50.

27-70. **The Arc Spectrum of Iron (Fe 1).** 207 pp., illus., paper, Transactions of the American Philosophical Society, New Series, v. 34, pt. 2. $2.25.

27-71. **Metallography of Magnesium and Its Alloys.** Walter Bulian and Eberhard Fahrenhorst. Translated from the German. 117 pp., illus., F. A. Hughes & Co., Ltd., Abbey House, N.W.1, London, England.

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27-72. **The Chemistry of Acetylene.** Julius A. Nieuwland and Richard R. Vogt. Reinhold Publishing Co., 330 West 42nd St., New York. $4.00.

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A basic text of the fundamental principles of radio, giving specific examples of practical applications, and the necessary mathematical tools.

27-75. **Steel Plant Refractories: Testing, Research and Development.** J. H. Chesters. 509 pp., United Steel Companies, Ltd., Sheffield, England.

A compilation of author's results of ten years' work in the refractories section of the Central Research Department of the United Steel Companies, Ltd., and of practical experience of other workers in this field. Methods of testing; silica and semi-silica; magnesite; dolomite; chrome and chrome-magnesite; alumino-silicates; insulation; basic open-hearth furnace above and below the sill-plate level; acid open-hearth furnace; acid and basic bessemer converters; electric steel plant; soaking pits and reheating furnaces; the casting pit. Appendices (46 pp.) give glossary of terms, properties of bricks, conversion tables and other useful data.

27-76. **Reports on the Measurement of Surface Finish by Stylus Methods.** R. E. Reason and R. I. Garrod. Taylor, Taylor and Hobson, Ltd., 30s.

27-77. **Praktische Physik; 17th ed.** Friedrich Kohlrausch. 958 pp., diagrs., Mary S. Rosenberg, 235 W. 108th St., New York 25, N. Y. $8.75.

27-78. **Einführung in die Elektronik.** Otto Klemperer. 303 pp., diagrs. Mary S. Rosenberg, 235 W. 108th St., New York 25, N. Y. $6.50.

27-79. **Books, Publications and Patents of Battelle Memorial Institute, 1929-1944.** 72 pp., Battelle Memorial Institute, Columbus 1, Ohio. Free upon request.

Catalog listing more than 800 journal contributions, books and patents in the fields of chemistry, welding,

applied mechanics, mineral dressing, industrial physics, ceramics, fuels and metallurgy.

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A collection of valuable, timely, practical commercial formulae and recipes for making thousands of products in many fields of industry. New formulae have been added and the directory of sources of chemicals and supplies has been enlarged. Chapter XII on metals and alloys covers the field in a long index of formulae ranging from aluminum plating to zinc coatings.

27-81. **Principles of Firearms.** Charles E. Balleisen. 154 pp., bibls., illus., diagrs., John Wiley & Sons, Inc., 440 Fourth Ave., New York. $2.50.

The operation of familiar weapons, analyzed from the viewpoint of a mechanical engineer. The author is in the U. S. Army Ordnance Department.

27-82. **Practical and Theoretical Photography** (2nd Edition). Julian MacFarlane Blair. 251 pp., illus., diagrs. Pitman Publishing Co., New York. $2.50.

The material has been brought up to date and a chapter on aerial photography and surveying and many new illustrations have been added. Practical aspects of X-ray, photomicrography and lantern slides are included.

27-83. **History of Photography.** Josef Maria Eder. Translated from the German by Edward Epstean. 880 pp., bibl., Columbia University Press, N. Y. $10.00.

A comprehensive examination of photography from Aristotelian light theories through the modern ramifications of photochrome.

27-84. **Engineering Preview, an Introduction to Engineering Including the Necessary Review of Science and Mathematics.** L. E. Grinter and others. 619 pp., illus., Macmillan Publishing Co., New York, N. Y. $4.50.

The primary purpose of this volume is to acquaint the prospective engineering student with those sciences essential to a study of engineering and to assist him in deciding whether he is suited for this profession.

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Properties of various plastics and fabricating methods, as they have proved themselves in commercial uses. For the designer or engineer who is not an expert in plastics.

27-86. **Electrical Coils and Conductors; Their Electrical Characteristics and Theory.** Herbert Bristol Dwight. 360 pp., bibl. diagrs. McGraw-Hill Publishing Co., 330 W. 42nd St., New York, N. Y. $5.00.

An advanced textbook with many numerical problems based on practical cases. A knowledge of practical operating principles of electrical coils and conductors is essential to the use of this volume.

27-87. **Hilfsbuch fur die praktische Werkstoffabnahme in der Metallindustrie; 2nd Edition.** Ernst Damerow and A. Herr. 117 pp., illus. J. W. Edwards Brothers, Ann Arbor, Mich. $3.75.

27-88. **Die chemische Emissions — Spektral — Analyse; pt. 3, Tabellen zur qualitativen Analyse; 2nd Edition.** Walther Gerlach and E. Riedl. 163 pp. J. W. Edwards Brothers, Ann Arbor, Mich. $3.25.

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27-91. **Technik der tiefen Temperaturen.** Johannus Antonius van Lammeren. 264 pp., bibl., illus. J. W. Edwards Brothers, Ann Arbor, Mich. $6.00.

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27-94. **Die elektrometrische (Potentiometrische) Massanalyse; 6th Edition.** Max Erich Müller. 315 pp., bibl., illus. J. W. Edwards Brothers, Ann Arbor, Mich. $5.50.

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27-96. **Elektrolytische Wanderung in flussigen und festen Metallen.** Karl Ernst Schwarz. 102 pp., bibl., illus., J. W. Edwards Brothers, Ann Arbor, Mich. $3.50.

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27-99. **Steam and Gas Turbines, With a Supplement on the Prospects of the Thermal Prime Mover.** Aurel Stodola. Translated from the sixth German edition by Louis C. Loewenstein. v. 1, 763 pp.; v. 2, 591 pp. Peter Smith, New York, N. Y. $20.00.

27-100. **Chronology of the Tinplate Works of Great Britain.** Edward Henry Brooke. Morgan & Higgs, Ltd., Union Street, Swansea, England. 8s.

27-101. **Mining Machinery; an Elementary Treatise on the Generation, Transmission and Utilization of Power for Candidates for the Under-Managers Certificate.** T. Bryson. 2nd Edition, 388 pp. Pitman Publishing Co., London, England, 17s. 6d.

27-102. **Welding and Brazing Alcoa Aluminum.** Aluminum Co. of America. Revised Edition. 110 pp. The Aluminum Co. of America, 2140 Gulf Bldg., Pittsburgh, Pa. Free upon request.

27-103. **Making Patent Drawings.** Harry Radzinsky. 103 pp., illus., diagrs. Macmillan Publishing Co., New York. $3.00.

The style prescribed by the United States Patent Office is followed in this guide for draftsmen. Most of the drawings are by the author and Julius H. Lutz.

27-104. **Quality Through Statistics.** A. S. Wharton. 69 pp., Philips Lamps, Ltd., London, England. 6s.

27-105. **Engineering Data.** Cincinnati Milling Machine Co. Oakley, Cincinnati, Ohio. 60 pp. Free upon request.

27-106. **Job Safety Training Manual.** Kenneth L. Faist and Stanton M. Newkirk. 70 pp., National Foreman's Institute, Deep River, Conn. $5.00.

27-107. **Flammable Liquids, Gases, Chemicals, and Explosives.** 560 pp., illus., National Fire Protection Association, Boston, Mass. $3.00.

27-108. **SAE Handbook, 1945 Edition.** 620 pp., Society of Automotive Engineers, 29 West 39th St., New York 18, N. Y. $5.00.

All SAE official current standards, including iron and steel, non-ferrous metals, and parts and fittings, plus general data. Revised standards include methods of determining steel hardenability, steel hardness conversion numbers, automotive gray iron castings, and NE steels.

27-109. **Chemistry of Coal Utilization; 2 v.** Prepared by the Committee on Chemical Utilization of Coal, Division of Chemistry and Chemical Technology, National Research Council. 2078 pp., bibl., illus., diagrs. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. $20.00.

A critical review of the world's literature on the origin and classification of coal, its physical properties and chemical nature and the chemistry of coal carbonization, combustion, gasification and hydrogenation. The chapters are written by experts in the various fields.

27-110. **Training for Supervision in Industry.** George H. Fern. 188 pp., McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. $2.00.

An understandable treatment for those concerned with the problems of training men for supervisory positions. Explains the conference method and deals specifically with such problems as maintaining mental health in

industry, handling problems of women workers, promoting safety, training new workers.

27-111. **Staffordshire Iron and Steel Institute** *Proceedings,* v. 61 and 62, edited by H. A. MacColl. Mark & Moody, Ltd., 52 and 53 High St., Stourbridge, England.

Papers and proceedings of 1940, 1941 and 1942 sessions, including Presidential Addresses; Steel for Sheets, by H. J. Merchant; and Some Practical Aspects of the Manufacture of Producer Gas, by E. Wood.

27-112. **Practical Design for Arc Welding. Vol. 3.** Robert E. Kinkhead. 200 pp., 8½ x 11, Hobart Bros. Co., Troy, Ohio. $3.50.

Sixty more design plates similar to those in the first two volumes, illustrating in graphic form valuable hints on what not to do in designing for arc welding, the origin of modern design principles, and typical patents granted in connection with the welding process.

27-113. **Procedure Handbook of Arc Welding Design and Practice.** Eighth Edition. 1312 pp., illus., Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, $1.50.

Entirely revised to include latest data on new arc welding methods and equipment; 16 new subjects added.

27-114. **High Pressure Die Casting, A Design Guide for Engineers.** H. L. Harvill and Paul R. Jordan. H. L. Harvill Mfg. Co., Los Angeles, Calif. $5.00.

Design aspects of die casting emphasized; comprehensive and usable chart of tolerances; one chapter devoted to pressure mold or premium quality die castings with particular reference to recent specifications; 25 typical die castings discussed. Glossary and index.

27-115. **Advances in Nuclear Chemistry and Theoretical Organic Chemistry.** R. E. Burk and O. Grummitt, Editors. 165 pp. bibl. illus. (Frontiers in Chemistry, v. 3) Interscience Publishing Co., New York, N. Y. $3.50.

27-116. **Electronics Laboratory Manual.** Ralph R. Wright. 77 p. bibl., diagrs., McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. $1.00.

A first course laboratory text for students of engineering, especially in the field of electricity.

27-117. **Piping Handbook; Fourth Edition.** Sabin Crocker. 1391 pp., bibl., diagrs., McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. $7.00.

New chapters on gas, refrigeration and hydraulic power transmission piping, and corrosion and further material on water-supply piping and flow.

27-118. **Plastics.** John Harry DuBois. Third Edition, 460 pp., illus., diagrs., American Technical Society, Chicago, Ill. $4.00.

27-119. **Heating, Ventilating, Air Conditioning Guide, 1944, 23rd Edition.** 1216 pp., American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York 10, N. Y. $5.00.

27-120. **Roller Bearings.** R. K. Allan. 401 pp., Sir Isaac Pitman & Sons, Ltd. Machinery Publishing Co., Ltd., 17 Marine Parade, Brighton, England. Price 30s net.

27-121. **The Simple Calculation of Electrical Transients; an Elementary Treatment of Transient Problems in Linear Electrical Circuits, by Heaviside's Operational Method.** G. W. Carter. 128 pp., bibl., diagrs., Macmillan Publishing Co., New York, N. Y. $1.75.

An explanation of the engineering side of electrical circuits and the algebra and calculus of their formulas.

27-122. **Cutting Tool Practice.** H. C. Town and D. Potter. Paul Elek, Ltd., Africa House, Kingsway, London, W. C. 2 England, 13s. 6d. net.

27-123. **Testing Machine Tools.** Fourth Edition. George Schlesinger, 94 pp. Machinery Publishing Co., Ltd., 17 Marine Parade, Brighton, England. Price 17s. 6d net.

27-124. **Cast Iron in the Chemical and Process Industries.** F. L. LaQue. 27 pp., Gray Iron Founders' Society, 33 Public Square, Cleveland, Ohio. $1.00.

Information on the properties and applications of gray cast iron.

27-125. **Kurzes Lehrbuch der Technologie der Brennstoffe.** Wolf Johannes Muller. 568 pp., illus., J. W. Edwards Co., Ann Arbor, Mich. $11.50.

27-126. **Wektor und Dyadenrechnung fur Physiker und Techniker.** Erwin Lohr. 426 pp., illus. (Arbeitsmethoden der modernen Naturwissenschaften), J. W. Edwards Co., Ann Arbor, Mich. $7.00.

27-127. **An Outline of Industrial Metallurgy.** D. G. P. Paterson and J. Bearn. Chapman & Hall, Ltd., II, Henrietta Street, London, W. C. 12s. 6d.

27-128. **Engineering Alloys.** N. E. Woldman and R. J. Metzler. 2nd Edition. 833 pp., American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $10.00.

Trade names of 12,550 alloys; physical properties; chemical compositions; uses; names of manufacturers; indexed.

27-129. **Catalytic Chemistry.** Henry W. Lohse. 416 pp., illus., Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. $8.50.

A factual presentation of the underlying principles of catalytic phenomena and the application of catalytic reactions in industrial processes.

27-130. **Experimental Stress Analysis; Proceedings of the Society for Experimental Stress Analysis;** Volume 3, No. 1. Addison-Wesley Press, Inc., Kendall Square, Cambridge 42, Mass. $5.00.

Semi-annual publication of the Society for Experimental Stress Analysis, containing the papers delivered at the symposiums. (May, 1945.)

27-131. **An Introduction to Magnesium and Its Alloys.** John Alico. Ziff-Davis Publishing Co., 350 Fifth Ave., New York 1, N. Y. $5.00.

An over-all picture of magnesium, describing its historical background, mechanical development, physical metallurgy of magnesium and the known casting and fabricating processes, commercial treatments and finishing and joining procedures.

27-132. **Collected Papers on Metallurgical Analysis by the Spectrograph.** D. M. Smith. 162 pp., illus., British Non-Ferrous Metals Research Association, Euston St., N.W.1, London, England.

Thirteen papers on processing and calibration of the photographic plate, analysis of aluminum, lead, zinc, copper and platinum.

27-133. **Machine Tool Guide; Engineering Data Covering the Machine Tools.** Tom C. Plumridge and Others. 773 pp., illus., diag., American Technical Society, Chicago, Ill. $7.50.

Especially prepared for tool engineers, millwrights, and tool equipment salesmen.

27-134. **A Bibliography on Cutting of Metals.** Orlan W. Boston. 561 pp., American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. $6.50.

4124 annotated references from 1864 to 1943 inclusive. Arranged alphabetically by authors and chronologically by years.

27-135. **Electroplating—a Survey of Modern Practice.** Samuel Field and A. Dudley Weill. 5th Edition. 483 pp., Pitman Publishing Corp., 2 West 45th St., New York, N. Y. $5.00.

Fundamental principles; electricity and electrochemistry; chemical analysis; sources of current; solutions; plants; cleaning; deposition of various metals; testing; coloring.

27-136. **Strength of Materials;** 4th Edition. Alfred P. Poorman. Illus., McGraw-Hill Book Co., 330 W. 42nd St., New York. $3.00.

27-137. **Machine Drawing and Design,** 4th Edition. W. Abbott. Blackie, London, 10s. net.

27-138. **Science in Progress.** Series 4. George A. Baitsell, 331 pp., Yale University Press, New Haven, Conn. $3.00.

27-139. **Factory Organization and Management.** N. F. T. Saunders. 163 pp., Sir Isaac Pitman & Sons, Ltd., Parker St., Kingsway, London, W.C.2, England. 10s. 6d. net.

27-140. **Future of Industrial Research.** 173 pp., Standard Oil Development Co., New York.

27-141. **Research, Invention, and Patents.** Andrey A. Potter. Industrial Research Institute, New York. Free.

27-142. **Practice in Machining Zinc Alloy Die Castings.** 68 pp., New Jersey Zinc Co., 60 Front St., New York. Free.

27-143. **Symposium on Stress-Corrosion Cracking of Metals.** 500 pp., American Institute of Mining & Metallurgical Engineers, 29 West 39th St., New York 18, N. Y. $7.50.

Thirty papers presented at the joint symposium held in November 1944 by the A.I.M.E. and American Society

for Testing Materials. Deals with stress-corrosion test methods and best results for brass, aluminum, magnesium and stainless steel; theory and mechanism of stress-corrosion cracking; season cracking of cartridge brass.

27-144. **Handbook of Non-Ferrous Metallurgy; Principles and Processes.** Donald Macy Liddell, Editor. 2nd Edition, 667 pp., illus., diagr. McGraw-Hill Book Co., 330 W. 42nd St., New York. $3.75.

The chapter on metallography has been deleted and one on drying, added.

27-145. **Internal-Combustion Engines: Theory and Design.** Vladimir Leonidas Maleev. 2nd Edition, 648 pp., illus., diagrs. McGraw-Hill Book Co., 330 W. 42nd St., New York. $5.00.

The material has been amplified and the theoretical discussion has been strengthened.

27-146. **Ebene Grundwasserstronungen mit Freier Oberflache.** Max Breitenoder. 133 pp., illus. J. W. Edwards, Ann Arbor, Mich. $4.85.

27-147. **Electric Motors and Generators and Related Drives.** Edwin Stoddard Lincoln. 389 pp., illus., diagrs. (Essential Books, Modern Electrical Series), Duell, Sloan and Pearce, New York. $3.00.

The types, uses and construction of motors for the production of commercial electric power.

27-148. **Electrical Measuring Instruments: Measurement and Surveys.** 291 pp., illus., diagrs. (Essential Books: Modern Electrical Series), Duell, Sloan and Pearce, New York. $3.00.

Principles of industrial electric measuring instruments, with tables.

27-149. **Industrial Electric Lamps and Lighting.** Edwin Stoddard Lincoln. 351 pp., illus., diagrs. (Essential Books: Modern Electrical Series), Duell, Sloan & Pearce, New York. $3.00.

Standards for industrial electric light and technical explanations of the circuits and installations.

27-150. **Electrical Protective Equipment and Power-Factor Correction: Fire Protection and Fire Fighting Equipment.** 251 pp., illus., diagrs. (Essential Books: Modern Electrical Series), Duell, Sloan and Pearce, New York. $3.00.

Devices and methods of protecting electrical circuits and equipment from fire.

27-151. **The Fundamentals of Electronics and Their Applications in Modern Life.** Henry Lionel Williams. 242 pp., illus., diagrs. New Home Library, Philadelphia. $0.69.

The elementary aspects of electron therapy and the tools of electronics and the applications of electronic devices.

27-152. **Diesel-Electric Plants.** Edgar Jesse Kates. 2nd Edition, 272 pp., illus., diagrs. American Technical Society, Chicago, Illinois. $3.75.

Greatly enlarged and revised to bring the text up to date with developments of the past nine years.

27-153. **The Technology of Plastics and Resins.** J. Philip Mason and Joseph F. Manning. 501 pp., illus., diagrs. D. Van Nostrand Co., New York, N. Y. $6.50.

A textbook presupposing courses in general chemistry and organic chemistry, and covering both the chemistry and the practical utilization of plastics and resins.

27-154. **The Electrolytic Capacitor.** Alexander M. Georgiev. 203 pp. Murray Hill Books, New York, N. Y. $3.00.

The construction, manufacture, function and testing of dry and wet electrolytic capacitors or condensers.

27-155. **Code of Minimum Requirements for Instruction of Welding Operators. Part A—Arc Welding of Steel $\frac{3}{16}$ to ¾ In. Thick.** 83 pp., illus., American Welding Society, 33 West 39th St., New York, N. Y. $0.50.

Revised edition, prepared by Committee on Minimum Requirements of Instructions for Welding Operators in Trade Schools. Prescribes equipment and facilities for the school, exercises and topics for lecture and discussion.

27-156. **Bibliography on Industrial Radiology.** Herbert R. Isenburger. 16 pp., mimeo., St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City 1, N. Y. $1.00.

Addenda to "Industrial Radiology." About 400 references, 1942-1945.

27-157. **Ball and Roller Bearing Engineering.** Arvid Palmgren. 270 pp., diagr., SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.

A fundamental text. Common bearing types; forces and motions in bearings; the carrying capacity of ball and roller bearings; bearing selection; design of bearing applications; mounting and dismounting; lubrication and maintenance; bearing failures; tables.

27-158. **Metal Fabrication by Risdon.** 129 pp., illus., Risdon Mfg. Co., Naugatuck, Conn.

A manufacturer's story of metal components, formed wire products and safety pins.

27-159. **Uranium and Atomic Power.** Jack DeMent and H. C. Dake. 343 pp., illus., Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. $4.00.

Atomic power; the uranium minerals; prospecting for uranium minerals; the physics of uranium; chemistry of uranium; specific methods in uranometry; appendix on the atomic bomb.

27-160. **Metallurgy.** Carl G. Johnson. Second edition, 262 pp., illus., American Technical Society, 850 E. 58th St., Chicago 37, Ill. $2.50.

Properties of metals and tests to determine their uses; chemical metallurgy; producing iron and steel; physical metallurgy; shaping and forming metals; some commercially important non-ferrous alloys; light metals and alloys; copper and its alloys; steel; heat treatments for steel; surface treatments; alloy or special steels; classification of steels; powder metallurgy.

27-161. **High Frequency Transmission Lines.** Willis Jackson. 159 pp., diagrs. (Methuen's Monographs on Physical Subjects) Transatlantic Arts, Forest Hills, N. Y. $1.80.

The properties of transmission lines and their applications in high frequency technique.

27-162. **Collision Processes in Gases.** Frederick Latham Arnot. 2nd edition. 112 pp., diagrs. (Methuen's Monographs on Physical Subjects) Transatlantic Arts, Forest Hills, N. Y. $1.50.

27-163. **Atom Smashers; a Story of Discovery.** Raymond Francis Yates. 182 pp., illus., diagrs., Didier, New York, N. Y. $2.00.

A simplified explanation of the theories of physics leading up to the atom bomb.

27-164. **Electronic Equipment and Accessories; Principles of Electronics and Their Applications in Industry.** Ronald Claude Walker. 401 pp., illus., diagrs., Chemical Publishing Co., Brooklyn, New York. $6.00.

Introductory electronics for practical engineers, mechanics, students and other readers who know the elements of electricity and magnetism.

27-165. **Principles of Physics—3. Optics.** Francis Weston Sears. 323 pp., illus., diagrs., Addison Wesley Press, Cambridge, Mass. $4.00.

The physical principles of optics; a college textbook.

27-166. **Theory of Structures.** Stephen Timoshenko and Donovan Harold Young. 502 pp., diagrs., McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. $5.00.

A development, with graded problems, of the methods of analysis of trusses and frames, from a basic knowledge of mechanics.

27-167. **Introduction to Industrial Chemistry.** William T. Frier and Albert C. Holler. 382 pp., illus., diagrs., McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. $3.00.

A textbook for industrial night schools, beginning with elementary chemistry and going on to a simplified explanation of chemistry's applications in industry.

27-168. **The Art of Calculation.** Harry Sticker. 256 pp., Essential Books. $2.00.

Basic method of arithmetical calculation.

27-169. **Atomic Energy for Military Purposes.** Henry DeWolf Smyth. 264 pp., illus., Princeton University Press, Princeton, N. J. $2.00.

The official report on the development of the atomic bomb under the auspices of the United States Government, 1940-1945. A republication, with slight modifications, of the official report issued by the Manhattan District.

27-170. **Minerals of Might.** William O. Hotchkiss. 206 pp., Jacques Cattell, Lancaster, Pa. $2.50.

A history of minerals and their influence on civilization.

27-171. **Evaluation of Effects of Torsional Vibration.** 576 pp., illus., 8½x11 in., Society of Automotive Engineers, 29 West 39th St., New York 18, N. Y. $10.00.

Experimental and analytical methods used by research departments of a number of leading diesel engine manu-

facturers in investigating and applying means of controlling torsional vibrations. Prepared at the request of the Navy by a special committee of the SAE War Engineering Board and 17 industrial experts.

27-172. **Chemistry for Electroplaters.** C. B. F. Young. 205 pp., Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. $4.00.

Designed to give the electroplater a fundamental knowledge of the theories underlying chemistry and definitions relating to electroplating.

27-173. **Magnetism.** Edmund Clifton Stoner. 2nd edition, 143 pp., diagrs. (Methuen's Monographs on Physical Subjects) Transatlantic Arts, Forest Hills, New York. $1.25.

Many of the sections have been rewritten and some new sections have been added.

27-174. **Coyne Electrician's Handbook, a Reference and Data Book.** 348 pp., diagrs., Coyne Electrical School, 500 S. Paulina St., Chicago 12, Ill. $2.75.

The essential formulae, charts, tables and code rules of the electrical field.

27-175. **Electronics for Electricians and Radio Men; an Instruction and Reference Book.** 442 pp., illus., diagrs., Coyne Electrical School, 500 S. Paulina St., Chicago 12, Ill. $4.95.

Electronic controls, measurements and processes for manufacturing, commercial and home installations.

27-176. **Coyne Electrical and Radio Dictionary, With Symbols.** 172 pp., diagrs., Coyne Electrical School, 500 S. Paulina St., Chicago 12, Ill. $0.50.

An up-to-date compilation of electronic terms, abbreviations, illustrations and symbols.

27-177. **Year Book of the American Bureau of Metal Statistics, 1944.** 112 pp., W. R. Ingalls, Director, 33 Rector St., New York, N. Y. $2.00.

24th annual issue of this standard reference work offers a more comprehensive survey of data than was possible a year ago.

27-178. **Machine Shop Operations. 1944-45 Edition.** J. W. Barritt and E. T. Larson. 850 pp., American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. $6.00.

Covers actual jobs for the lathe, milling machine, slotter, horizontal boring mill, shaper, drill press, planer, vertical boring mill, grinder, measuring tools, bench work, floor work and layout work.

27-179. **Pattern Making.** James Ritchey, revised by Walter W. Monroe, Charles William Beese, and Phillip Ray Hall. 233 pp., illus., American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. $2.00.

Covers fully the subject of pattern making, discussing tools and equipment necessary, design details of simple and complicated patterns for typical cases, use of green and dry sand cores, and construction and design of typical molding machines with details as to manner in which the castings are designed to suit the machine.

27-180. **Electrical Measuring Instruments—Measurements and Surveys.** Edwin S. Lincoln. 228 pp., illus., Essential Books, 270 Madison Ave., New York, N. Y. $3.00.

Electrical measuring instruments; electrical measurements; industrial electrical survey.

27-181. **Electric Motors and Generators and Related Drives.** Edwin S. Lincoln. 382 pp., illus., Essential Books, 270 Madison Ave., New York, N. Y. $3.00.

Chapters on a.c. and d.c. motors and generators. General aspects, standardization, operating characteristics. Major designs have pertinent illustrations and tables. Separate chapters cover synchronous motors, motor-generator sets, fractional-hp motors, charging and electroplating generators, emergency engine-generating sets and torque motors.

27-182. **Mining Directory of Minnesota, 1945.** Henry H. Wade. 234 pp., Mines Experiment Station, Minneapolis, Minn. $1.00.

Answers to questions that arise regarding individual properties, companies, personnel, affiliates, fees and leases, production, taxes, etc., in the Minnesota iron country.

27-183. **Mining Yearbook, 1945.** Walter E. Skinner, 20 Copthall Ave., London, E.C.2. 26s, net.

59th annual issue of this standard reference work contains complete and up-to-date information about 811 mining companies operating in all parts of the world.

27-184. **Minerals Yearbook, 1943.** U. S. Bureau of Mines. Superintendent of Documents, Washington 25, D. C. $2.50.

Heretofore confidential 1943 volume on the production, distribution, and consumption of mineral commodities.

27-185. **Condensed Mining Handbook of Utah.** Robert S. Lewis. Bulletin 29. 130 pp., Department of Mining and Metallurgical Research, University of Utah, Salt Lake City. $1.00.

A mining directory which includes all metal, non-metal and coal mines in the State.

27-186. **The System of Mineralogy of James Dwight Dana and Edward Salisbury Dana. Volume 1, Elements, Sulphides, Sulphosalts, Oxides.** Seventh edition rewritten and enlarged by Charles Palache, Harry Berman, and Clifford Frondel. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

One of three volumes covering the complete revision of the old Dana system of mineralogy. Because of the difficulty of trying to incorporate the masses of new mineralogical data accumulated over the period of half a century this volume has become essentially a new work rather than a revision of the older Dana.

27-187. **Economic Mineral Deposits.** Alan M. Bateman. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

Deals with mineral deposits, how they are found, how and where they occur, and what they are. The book is divided into three sections: (1) General principles and processes, (2) metallic mineral deposits, (3) non-metallic mineral deposits.

27-188. **Lessons in Arc Welding.** 176 pp., illus., Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. $0.50.

Sixty-one lessons in welding with questions and answers.

27-189. **Atomic Energy in War and Peace.** Gessner G. Hawley and Sigmund W. Leifson. Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. $2.50.

Explanation of fundamental concepts; story of atomic bomb project; future military and industrial applications of atomic energy

27-190. **Acid Open-Hearth Slag Fluidity and Its Significance.** G. R. Fitterer, J. W. Linhart, B. B. Rosenbaum, J. B. Kopec, S. Poch, W. G. Wilson. 60 pp., Acid Open-Hearth Research Association, Inc., P. O. Box 1873, Pittsburgh, Pa. $1.00.

Practical methods of measuring slag fluidity and development of a standard fluidity test. Design of a standard tube-type fluidimeter mold applicable to all types of acid open-hearth practice.

27-191. **The Heating of Steel.** M. H. Mawhinney. 265 pp., illus., Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. $4.75.

A practical discussion of those features of heating methods and of furnace tools which are important in obtaining the best results from the heating of steel. Chemical effects of heating steel; fuels and burner equipment; temperature distribution and furnace control; heat transfer and fuel economy; quenching of steel; alloys and refractories; steel mill furnaces.

27-192. **The Machinists' and Draftsmen's Handbook.** Albert M. Wagener and Harlan R. Arthur. 662 pp., illus., D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N. Y., $4.50.

Symbols and mathematics; parts of the circle; areas; volumes; geometrical constructions; weights and measures; triangulation; drills; threads; spur gearing; milling; tables; tapers; miscellaneous tables; speeds; feeds; and cutting tools; dies and presses; metals; strength of materials; mechanics; and logarithms.

27-193. **Mercury Arcs.** Frederick Jerrold Teago and James Francis Gill. 111 pp., diagr. (Methuen Monographs on Physical Subjects) Transatlantic Arts, Forest Hills, N. Y. $1.25.

A survey of important aspects of the arc from electrical, mechanical and operational standpoints.

27-194. **Aircraft Production Design.** James E. Thompson. 238 pp., Aviation Press, 1590 El Camino Real, San Carlos, Calif. $5.00.

Design of all forms of aircraft parts treated from point of view of machine tools and processes used to manufacture them. Repair as a factor in design, materials for airframe construction and designing for machinability are chapter topics of unusual interest.

27-195. **Air Compressors.** Eugene W. F. Fuller. 450 pp., McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18. N. Y. $4.50.

All types and designs of air compressors covered in detail including the axial compressor used in gas turbines. Working parts described and operations explained.

27-196. Elementary Statistics and Applications. J. G. Smith and A. J. Duncan. 720 pp., McGraw-Hill Book Co., Inc., 330 W. 42nd St.. New York 18, N. Y. $4.00.

Main divisions of the book are: Analysis of frequency distributions, the normal frequency curve, study of bivariates and multivariates, study of dynamic variability and forecasting.

ADDRESSES OF PUBLICATIONS

Acoustical Society of America Journal, 57 E. 55th St., New York 22, N. Y.
Aero Digest, 515 Madison Ave., New York 22, N. Y.
Aeronautical Engineering Review, 2 E. 64th St., New York 21, N. Y.
Aircraft Engineering, 12 Bloomsbury Sq., London, W.C.1, England
Aircraft Production, Stamford St., London, S.E.1, England
Alloy Casting Bulletin, 39 Broadway, New York
Alloy Metals Review, Ditton Road, Widnes, Lancashire, England
Aluminum and Magnesium, 425 W. 25th St., New York 1, N. Y.
Aluminium and the Non-Ferrous Review, 25 High St., Merton, S.W.19, England
American Ceramic Society Bulletin, 2525 N. High St., Columbus 2, Ohio
American Ceramic Society Journal, 2525 N. High St., Columbus 2, Ohio
American Chemical Society Journal, 1155 16th St., N. W., Washington 6, D. C.
American Dyestuff Reporter, One Madison Ave., New York 10, N. Y.
American Electroplaters' Society Monthly Review (See Monthly Review)
American Foundryman, 222 West Adams St., Chicago 6, Ill.
American Foundrymen's Association Transactions, 222 West Adams St., Chicago 6, Ill.
American Gas Association Monthly, 420 Lexington Ave., New York 17, N. Y.
American Gas Journal, 53 Park Place, New York 7, N. Y.
American Institute of Chemical Engineers Transactions, 15 North 7th St., Philadelphia 6, Pa.
American Institute of Electrical Engineers Transactions, 33 W. 39th St., New York 18, N. Y. (See Electrical Engineering)
American Institute of Mining and Metallurgical Engineers Transactions, 29 W. 39th St., New York 18, N. Y. (See also Metals Technology, Mining Technology)
American Institute of Physics (See Reviews of Modern Physics)
American Iron and Steel Institute Yearbook, 350 5th Ave., New York 1, N. Y.
American Machinist, 330 W. 42nd St., New York 18, N. Y.
American Mineralogist, 450-454 Ahnaip St., Menasha, Wis.
American Paint Journal, 3713 Washington Ave., St. Louis 8, Mo.
American Petroleum Institute Quarterly, 50 W. 5th St., New York 20, N. Y.
American Pressman, Pressmen's Home, Tenn.
American Printer, 56th & Chestnut Sts., Philadelphia 39, Pa.

American Railway Engineering Association Bulletin, 59 E. Van Buren St., Chicago 5, Ill.
American Society for Metals Transactions, 7301 Euclid Ave., Cleveland 3, Ohio
American Society for Testing Materials Bulletin, 260 S. Broad St., Philadelphia 2, Pa.
American Society for Testing Materials Proceedings, 260 S. Broad St., Philadelphia 2, Pa.
American Society of Mechanical Engineers Journal, 29 W. 39th St., New York 18, N. Y.
American Society of Mechanical Engineers Transactions, 29 W. 39th St., New York 18, N. Y.
American Society of Naval Engineers Journal, Navy Bldg., Constitution Ave., 16th & 17th Sts. N.W., Washington, D. C.
American Society of Tool Engineers (See Tool Engineer)
American Water Works Association Journal, 500 Fifth Ave., New York 18, N. Y.
American Welding Society (See Welding Journal)
Analyst, Hills Road, Cambridge, England
Architectural Forum, Time Inc., 350 5th Ave., New York 1, N. Y.
Architectural Record, 34 N. Crystal St., E. Stroudsburg, Pa.
Archiv fur Eisenhuttenwesen, Breite Str. 27, Dusseldorf, Germany
Army Ordnance, Suite 705, Mills Bldg., Washington 6, D. C.
Australasian Institute of Mining and Metallurgy Proceedings, 399 Little Collins St., Melbourne, Victoria, Australia.
Automobile Engineer, Dorset House, Stamford St., London, S.E.1, England
Automotive and Aviation Industries, Chestnut and 56th St., Philadelphia 39, Pa.
Aviation, 330 W. 42nd St., New York 18, N. Y.

Bell Laboratories Record, 463 West St., New York 14, N. Y.
Bell System Technical Journal, 195 Broadway, New York, N. Y.
Better Enameling, 1427 South 55th Court, Cicero 50, Ill.
Blast Furnace and Steel Plant, 108 Smithfield St., Pittsburgh 30, Pa.
Brick & Clay Record, 59 E. Van Buren St., Chicago 5, Ill.
British Cast Iron Research Association Bulletin, Alvechurch, Birmingham, England
British Ceramic Society Transactions, The North Staffordshire Technical College, Stoke-on-Trent, England
British Non-Ferrous Metals Research Association Bulletin, Euston St., London, N.W.1, England
British Plastics, Dorset House, Stamford Street, London, S.E.1, England
British Steelmaker, 9 Adam St., Strand, London, England
Brown Boveri Review, Baden, Switzerland
Business Week, 330 West 42nd St., New York 18, N. Y.

Canadian Chemistry and Process Industries, 137 Wellington St., West, Toronto 1, Ontario, Canada
Canadian Metals & Metallurgical Industries, 137 Wellington St., West, Toronto 1, Ontario, Canada
Canadian Mining and Metallurgical Bulletin, 906 Drummond Bldg., Montreal, Quebec, Canada
Ceramic Age, 421 Parker Street, Newark 4, N. J.
Ceramic Industry, 59 E. Van Buren St., Chicago 5, Ill.
Chemical Age, 154 Fleet St., London, E.C.4, England

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Chemical and Engineering News, 1155 16th St., N. W., Washington, D. C.
Chemical & Metallurgical Engineering, 330 W. 42nd St., New York 18, N. Y.
Chemical Industries, 522 Fifth Ave., New York 19, N. Y.
Chemical, Metallurgical and Mining Society of South Africa, P. O. Box 4256, Johannesburg, South Africa
Chemical Reviews, Baltimore 2, Md.
Chemist Analyst, Phillipsburg, N. J.
Coal Age, 330 W. 42nd St., New York 18, N. Y.
Coal Heat, 20 W. Jackson Blvd., Chicago, Ill.
Coke and Smokeless Fuel Age, 33, Tothill St., Westminster, London, S.W.1, England
Colliery Guardian, 30 & 31 Furnival Street, Holburn, London, E.C.4, England
Combustion, 200 Madison Ave., New York 16, N. Y.
Compressed Air Magazine, Phillipsburg, N. J.
Corrosion and Material Protection, 1131 Wolfendale Street, Pittsburgh, Pa.
Crown, Box 1837, Baltimore 3, Md.

Die Casting, 1240 Ontario St., Cleveland, Ohio
Domestic Commerce, Superintendent of Documents, Government Printing Office, Washington 25, D. C.
Drop Forging Topics, 605 Hanna Bldg., Cleveland 15, Ohio

Edgar Allen News, Edgar Allen & Co., Ltd., Sheffield 9, England
Electric Light and Power, 360 North Michigan Ave., Chicago, Ill.
Electrical Engineering, 33 West 39th St., New York 18, N. Y.
Electrical Manufacturing, 1250 Avenue of the Americas, New York 20, N. Y.
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